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THE AMERICAN TRANSCONTINENTAL EXCURSION OF 1912.*

By GEORGE G. CHISHOLM, H. O. BECKIT, and ALAN G. OGILVIE.

I. ECONOMIC ASPECTS.

By GEORGE G. CHISHOLM, Lecturer in Geography, University of Edinburgh.

BEFORE entering upon my special subject it will be well to begin by giving a brief account of the excursion which forms the general subject of the papers to be read this evening. The excursion was organized in order to celebrate the 60th anniversary of the foundation of the American Geographical Society of New York, and the occupation of the new building erected for that Society in Broadway. The organizer of the excursion was Professor W. M. Davis, Emeritus Professor of Geology in Harvard University, who needs no introduction to this Society. As is well known, he has been the main influence in giving its present direction to the teaching of geography, it may be said, throughout the United States, and has exerted a large amount of influence in the same direction in other countries. The remarkable success of the expedition in every detail was a testimony to his great organizing power. The members of the expedition consisted of professors and others associated with the subject of geography both in America and on the Continent. The great majority were present at the invitation of the American Geographical Society of New York, but the company also included a few students of geography who took part in the excursion at their own charges.

Among the other members of the excursion may be mentioned first among our hosts Professor Dodge, well known as the editor of the *Journal of the American Association of Geographers*, and, it may also be of interest

* Royal Geographical Society, June 23, 1913. Map, p. 420.

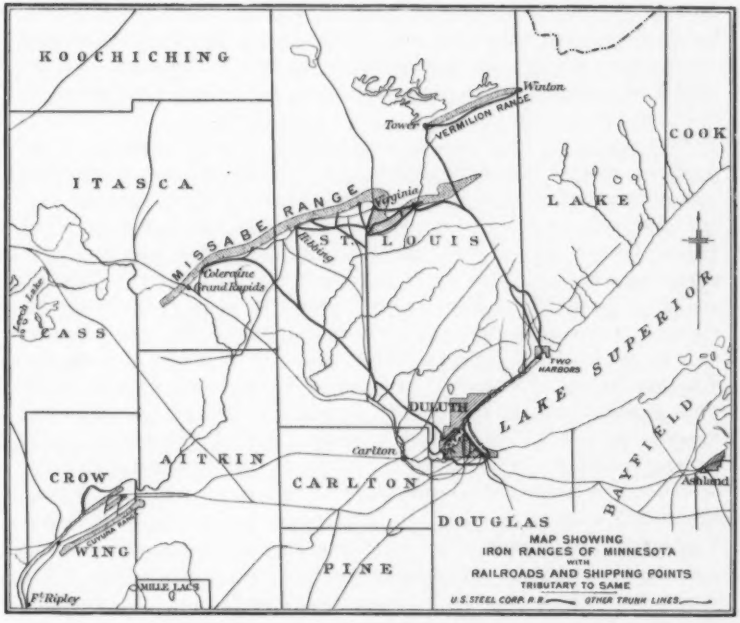
to mention here, author of a school geography widely sold in the United States in which the subheading of the "Mother Country" comes at the beginning of the section devoted to the United Kingdom. The Continental members included Professor Partsch, now of the University of Leipzig, first made known in this country through the visit of Dr. Keltie to his Geographical department at the University of Breslau nearly thirty years ago, and afterwards as the author of the volume on "Central Europe" in Mr. Mackinder's series of regional geographies; Professor Oberhummer of the University of Vienna, President of the I. and R. Geographical Society, Vienna; Professor Brückner of the same University, celebrated for his laborious investigations on the subject of climate; Professor Gallois of the University of Paris; Mr. Emmanuel de Margerie, one of the associate editors of the Annales de Géographie; Professor de Martonne, author of the valuable *Traité de Géographie Physique;* General Schokalsky, Professor of physical geography at the Académie Navale, St. Petersburg; and Professor Emile Chaix of Geneva, to the completion of whose atlas of the forms of terrestrial relief geographers throughout the world are looking forward with the keenest interest.

The route followed by the excursion, which started from New York on August 22, is shown on the accompanying map, and with regard to that route all that need be said in advance is that, while it was planned so as to show as much of interest in the geography of the United States as could be done in the course of two months, so vast and varied are those resources that some of the most important of these scarcely came under our eyes. Thus, though the United States has for many years been by far the most important coal-producing country in the world, it was only in the latter part of the excursion, so far as I recollect, in the part of the journey between Birmingham, Ala., and Chattanooga, that we came within sight of a coal-mine, and only in one small part of the trip, on approaching Toledo in skirting the south-western shores of Lake Erie, did we pass through any considerable tract of maize.

From the economic point of view the main general impression conveyed, to my mind at least, by the excursion was the rapidity of change and the wide-reaching effects of change in the development of a new country by people having at their command the modern methods of transport and production. A reminder of such changes was conveyed to us by the first day's journey, which took us up the Hudson valley and westwards into the Mohawk valley, the opening up of which by the Erie canal in 1825 first gave full value to the magnificent harbour of New York. Our first stopping-place was at Beacon Hill above Fishkill, on the left bank of the Hudson, from the summit of which we got a view of the Hudson and its banks which called to our minds the changes that had taken place since then. Though it had been the waterway of the Hudson and the Mohawk valley that first developed the western traffic to New York, the absence of shipping on the Hudson was an illustration of the fact that that method

of transport had in recent years been to a large extent displaced by the all-conquering railway, a railway, however, which still follows the same route to the west as that which determined the line of the Erie canal. Before leaving that valley our train was halted at Lockport for a few minutes in order to enable us to see the works at present in progress for the widening and deepening of that canal and the enlargement of its locks in the hope of once more making the waterway along this line an important means of communication between east and west.

In following this valley it was interesting to note that we were passing in succession through a number of small towns mainly devoted to manu-



factures. This fact, it may be mentioned, is to some extent associated with the changes to which reference has already been made. The railways to the west opened up regions favourable to agriculture in the prairies and North America with which many of the older agricultural districts of the United States could not compete. This was particularly so in a large part of the state of New York, where, for example, between the censuses of 1890 and 1900 there was an absolute diminution of the population. The population moved partly westwards to where the farming conditions were more favourable, partly into the towns of this valley where they furnished labour for manufacturing industries, maintained by the agricultural

industries of the west. Compared with the manufacturing towns of this country these towns present an interesting contrast in the fact that they are far from coal, not a single ton of coal being mined in the state of New York. But in the United States this is no special peculiarity of this district. Unlike those of Great Britain, the coalfields of the United States have comparatively few large manufacturing towns or even small manufacturing towns situated upon them. The manufactures of the United States have for the most part grown up in the north-east, where the great bulk of the population is, supplying at once the bulk of the labour and the chief market. The coal is hauled there in enormous quantities and for great distances, so that the lack of the coal is no hindrance to the development of manufactures in this valley as compared with other parts of the United States. On the other hand, the valley had to some extent the advantage of local water-powers, though this counts for comparatively little now, and the further advantage of being situated on the great through route which we were now following to the west.

The change to which we are now referring, the development of the American west by means of railways, was one which at first imparted an important stimulus to the iron and steel industries of our own country, but of late years a rapid change has taken place in this respect which has displaced this country from the leadership among the iron and steel producing countries of the world, making it come behind even Germany and much further behind the United States. To show how sudden this change was, I may quote the following passage from 'The Story of Iron and Steel,' by Dr. J. Russell Smith, Assistant Professor of Industry, Wharton College of Finance, University of Pennsylvania *:—"In 1884, when England was the iron leader, we began to unload the cargoes of Superior ore with shovels, buckets, windlasses, and wheelbarrows, much as George Washington would have ordered it done if he had required the operation to be performed in connection with his army movements. Within twenty-five years all this has been transformed as completely as George Washington's stagecoach. The ore is never touched by human hand, and with the exception of a very small percentage lying in the bottom of the ship, it is not even lifted by human muscle from the time it is loosened from its age-long resting-place beneath the pine roots of the Lake Superior woods until it goes into a seething furnace on the banks of the Monongahela."

Our next stoppage was one that brought the nature of these changes visibly before our eyes. It was at the works of the Lackawanna Steel Company at Buffalo, where we saw one of the great lake steamers laden with iron ore from Lake Superior being unloaded by the method described, and afterwards saw the steel being shaped into rails in 60-foot lengths with the minimum of labour referred to. I pass over the intervening tract of country between Buffalo and one of the principal sources of these

* Pages 113–114.

ores near Duluth at the head of Lake Superior. The deposit of iron ores visited by us was the most remarkable of all, and the most remarkable as yet known throughout the world. It is that of the Mesaba range about 70 miles to the north of the west end of Lake Superior, where an immense deposit of iron ores of commercial quality situated close to the surface in a condition ready for handling by mechanical shovels or grabs was discovered in 1892. Hibbing, the small iron-mining village visited by us, was started in 1893. From one mine alone adjoining that village, the Hull Rust mine, three million tons of ore are now removed annually. The first operation is simply to remove a comparatively thin skin of glacial deposits from the surface. After that, terraces are worked out in the ore, and along these terraces run lines of cars drawn by locomotives and loaded by the grabs in scoopfuls of seven to ten tons at a time. So cheap is this method of loading that, according to a British Consular report, on one occasion some 290,000 tons of ore were loaded at a cost of 2*d.* per ton.* The ore, too, is in large measure of the best quality. Both Bessemer and non-Bessemer ores are included. The different kinds are graded with such care that no variation of more than one-half of one per cent. in silica or 0·001 per cent. in phosphorus is allowed. In the cars the ore is conveyed to the fine harbour of Duluth, where it is allowed to fall by gravity from the ore docks to the steamers alongside. The cars are first emptied into large pockets or shoots, from which it flows into the holds of the vessels, these pockets having an average capacity of six-car loads, probably between 200 and 300 tons each. In three docks in Duluth sixteen vessels have been known to be loaded at once with 125,000 tons in one day. On one occasion, when special preparations were made, a vessel of nearly 10,000 tons was loaded in 25 minutes, and on another one of 12,000 tons in 42 minutes. The average rate of loading, however, including delays, is only about 1000 tons an hour.

Mr. Russell Smith has emphasized the small amount of labour now involved in the handling of iron ores and in the production of standard articles of iron and steel, but it will be readily understood that the conditions just described have given rise to various branches of the iron industry involving the employment of much greater quantities of labour; and in connection with that we may note, as one of the far-reaching effects of the present economic development of the United States, the great variety of sources from which that labour is supplied, in illustration of which it may be mentioned that the American Steel and Wire Company lately had to issue a notice about accident compensation in thirteen languages—Polish, Ruthenian, Croatian, Hungarian, Swedish, Norwegian, Finnish, Greek, Turkish, Armenian, Italian, German, and English.† I have given

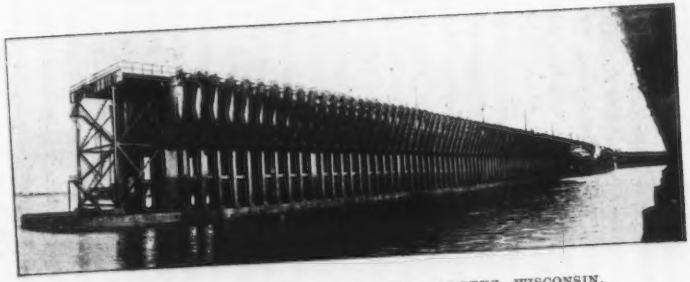
* Foreign Office Reports, Miscellaneous Series, No. 583.

† Dr. Ernst Schulze in a paper on "Die Handelsbeziehungen Kanadas zu den Vereinigten Staaten" in the *Zeitschrift für Sozialwissenschaft*, Sept. 1912, p. 631.

these languages in the order in which I found them recorded, and I do not suppose that it is merely an accidental matter that English comes last, for the labour that we have here to do with is no doubt the lowest class of labour employed in factories, and the probability is that in many such cases the English language holds in fact a very insignificant position. For, as was pointed out to me by Mr. Whitbeck of the University of Wisconsin (Madison), the movement of labourers in the United States is not merely onward but upward. Little of the lowest class of labour is now done by English-speaking inhabitants of the United States. Formerly all of it or a great part of it was done by Irish, but now they do none of it. The Irish are now policemen, overseers, contractors, not navvies. Next came the Italians, but Italians of the second generation are never found in those employments. They become barbers, retailers of fruit, sweetmeats, etc. Now the lowest class of labour is done by Croatians and other south-eastern Europeans. When the party visited Salt Lake City in Utah it was intended that it should visit the copper-mines of Bingham. A strike, however, then going on prevented that visit from being carried out, but we were informed that the miners there were Finns, Poles, Greeks, Italians. We were able to visit a mill in which the ores from that mine are concentrated, and there we found that while the highest-grade labourers earning a wage of from $2\frac{1}{2}$ to 4 dollars a day were mainly Americans, the washers and other second-grade labourers were Japanese, Greeks, Italians, and others employed at $1\frac{3}{4}$ dollars per day. Great numbers of the Italians, however, engage in agriculture, and as farmers we were informed they are excellent, paying a good rent and making the farms yield from two to three times as much as the American farmers do. And in connection with that I may mention another of the wide-reaching reactions of the economic development now going on in the United States, that the recent Italian commission appointed to investigate social and economic conditions in southern Italy reported that Italians returning from the United States with their savings were doing a great deal to bring about a resurrection in that part of the kingdom. The large emigration thence had raised the price of labour to such an extent that the large landowners no longer found it profitable to work their estates, but Italian families returning from the United States were able to buy from their former landlords small parcels of land which they were able to work with profit for themselves.

This circumstance may serve to lead us back to the subject of agriculture in the United States generally. After leaving Duluth we rapidly got into the prairie region of the United States, passing through Minnesota and North Dakota into Montana. Before reaching the prairies, however, it should be mentioned that we traversed a considerable tract of virgin forest in the parts of Minnesota adjoining Duluth. One of our stopping-places was Bismarck upon the Missouri, the capital of North Dakota, where we had an excellent view of prairie conditions in which wheat is still the main staple of agriculture. Notwithstanding the remarkable uniformity

THE MAHONING MINE, HIBBING, MINNESOTA. LARGEST OPEN IRON PIT IN THE WORLD. LOCATED ON THE GREAT NORTHERN RAILWAY.



GREAT NORTHERN RAILWAY ORE DOCKS, ALLOUEZ, WISCONSIN.

presented to our eyes for mile after mile, here also we found ourselves in a region of incessant change. Among the pioneers in the north-west of the United States, as now also in Canada, wheat is apt to be at first almost the sole crop for several reasons, mainly connected with the cheapness of the land. The fact that the land is cheap makes it a matter of little moment how much of it is occupied, and the main aim of the grower is to extend his agricultural employments over as wide an area as possible. The cheapness of the land is due to the smallness of the population, and that implies the dearth and the high price of labour, and wheat is one of the crops that involve the least expenditure of labour, where machinery can be employed to advantage and a high yield per acre is not an essential consideration. As one of the officials on the experimental farm at Ottawa said to me on one occasion, "Wheat is the only crop that you can leave for three months after sowing without paying any attention to it." But as population increases these conditions alter. The increase of population along with the improvement in communications, which in new countries is one of the conditions of that increase, rapidly enhances the value of the land, making it necessary for the farmer to get more out of each acre, and accordingly to devote himself to a different style of farming, involving at least a greater variety of crops. The whole process has been set forth with reference to the state of Minnesota in an interesting manner by Professor C. W. Thompson, in an article on the movement of wheat growing in the quarterly *Journal of Economics*, August, 1904. What Professor Thompson there shows to have gone on within the state of Minnesota is what has been steadily going on in a large part of the United States as a whole—steady increase in population, steady rise in land values, steady alteration in the character of the agriculture, and that resulting in the rapid movement of pioneer wheatfarming further to the west and north-west. This has involved migration from the east and immigration from Europe, and latterly also, as is well known, a rapid stream of emigration from the west of the United States across the border into Canada where the most favourably situated wheat-growing lands are now to be found. This westerly and north-westerly movement has been urged on chiefly by two things, first by the fact that this is the most profitable form of farming for those who have only a moderate amount of capital, and secondly by the very fact of the rapid rise of land values which tends to alter that farming as the movement proceeds. It has been said, with special reference to the wheat growers of the western prairies, that "the wheat farmer is far less a farmer than a speculator," * the rise in the value of his land being in many cases a more important part of the return on his capital and labour than the money which he obtains for his crops.

I have said that it is in Canada that the most favourable conditions of

* The 'United States Agricultural Year-Book for 1908,' quoted in 'The Farmer's Outlook' by R. T. Hinckes, p. 75.

North America are now being found for pioneer wheat farming. Our progress westwards next took us into the regions which are now being developed by what is sometimes called dry farming. On our route the dry farming country begins in the western part of North Dakota. Some hundreds of miles further on, after passing through the Bozeman tunnel in western Montana, the results of dry farming were brought before our eyes in a sufficiently attractive manner. We passed through an immense plain at the head of the Gallatin valley nearly surrounded by mountains, the plain presenting a scene of almost unbroken cultivation—towards the east oats, barley, wheat; further west in one place on the south of the line an unbroken area of alfalfa or lucerne extending to thousands of acres on one side, while a single grain crop extended over an equal area on the opposite side. Near Bozeman is situated the state agricultural college of Montana, and from that point we had the advantage of having with us throughout the state of Montana the presence of Prof. Linfield, director of the Montana agricultural experiment station, and of learning from him some of the marvels of that method of cultivation to which of late so much attention has been called. Although it is only of recent years that we in this country have heard much about it, the practice of dry farming has in certain parts of the world, as in the north-west of India and in southern Russia, been carried on from time immemorial, and it was interesting to learn from Mr. Cooper, the land commissioner and assistant president of the Northern Pacific Railroad, that it was Russians who, about 1890, first introduced it in the United States—settlers at Ritzville, Adams County, in the state of Washington, about 1890. But, once introduced, the methods of dry farming have been studied in the United States with the scientific eagerness which has for many years characterized the agricultural departments of that country. What has been ascertained is of great interest, but upon that subject I will be as brief as possible inasmuch as it was treated of at considerable length in a paper recently contributed to this society.* I will merely say that, notwithstanding the remarkable results that have been obtained in certain cases by the methods of farming that are so called, it is manifest that the spread of population westwards has driven agriculture into regions where the conditions are much less favourable than those found in the regions further to the east. It is obvious that dry farming involves a greater amount of human labour for a certain return, as well as the occupation of a considerably greater extent of land, although in certain cases large crops have been obtained from the same ground in two successive years. The essential principle of dry farming, as is well known, is to store up the water of at least two successive years in order to get a single crop, the field that gives a crop in one year being left fallow the next, and the method of storing up the moisture is that of repeated cultivation after rain so as always to have a surface coating of dry earth, and thus bring about a

* *Geographical Journal*, vol. 39, pp. 421 *et seq.*

breach of continuity in the capillarity of the soil. Though it is true that crops can be obtained from time to time from a very limited rainfall indeed, Professor Linfield considered that the limit of rainfall suitable for dry farming was about 10 inches west of the mountains, where they get winter rains, while 12 or 14 inches was a safer limit east of the mountains where the rains occur mainly in summer. Further, the risk of total loss is not inconsiderable, and there is always the chance of that loss being made all the greater through the fact of farmers being encouraged by the good results of one or two successive favourable years to venture on excessive outlay which may be followed by disastrous years. One case was mentioned to us in which the settlers on the High Horse plateau in the neighbourhood of the Yakima valley in Washington got only one crop in four years. In these circumstances it is not to be wondered at that Mr. Cooper should have declared that, notwithstanding all he has done to extend the knowledge of the methods of dry farming, he himself would rather set about clearing the woods of northern Minnesota than take up a dry farm.

At the same time, Mr. Cooper made it quite clear what the difficulty was that retarded the clearance of the Minnesota woodlands. The clearing, he told us, cost 60 dollars an acre; that means somewhere about £2000 for a 160-acre farm, an amount much beyond what is generally at the disposal of the pioneer wheat farmers. But I would take this opportunity of making a suggestion to Mr. Cooper. The Canadian Pacific Railway is at present engaged in providing ready-made farms in a part of Canada where a good deal of capital is required to give the promise of successful farming in consequence of the lack of water. The railway is not merely providing the means of irrigation, but also providing, apart from implements, the complete equipment of a farm under conditions that may enable men with moderate capital to take it up. Would it not be possible for the Northern Pacific Railroad to undertake the clearing in the Minnesota woods themselves, and to provide ready-made farms in the cleared ground under conditions that would offer the same inducement. In the olden times religious sentiment provided much of the capital for economic development. The monks made circular clearings round their monasteries. Nowadays banks discharge this function in an even more efficient manner by providing a motive for saving, and if railroads expended the capital which banks accumulate in the manner which I have suggested, the effect would be essentially the same, only the process of clearing would probably take place more rapidly and with a linear instead of a circular arrangement of the clearings.

The next regions that we visited enabled us to understand what prevented settlers with a sufficient amount of capital for the clearing of woods from entering upon that undertaking in the mean time. We passed on to fruit-growing valleys where the cultivation depended upon irrigation. The returns obtainable from this investment of capital have led to a rapid

development of recent years in the few localities of the west in which the necessary favourable conditions are found. The first fruit-growing valley that we visited was that of the Yakima, a valley leading into that of the Columbia in the south-east of the state of Washington. There apples, peaches, grapes, and other fruits are grown in abundance, and with such profit that the town of North Yakima, where we stopped, has grown to be an attractive and prosperous town within a very few years, in spite of some adverse conditions. The chief difficulty at present is in connection with such perishable fruits as peaches, which, ripening within a very short period, are apt to glut the market, so that at the time of our visit, word had had to be sent to send no more peaches eastwards as no sale could be found for them. It is otherwise, however, with the hardier fruits, such as the apple, which can be sent with profit even to Europe. I was, indeed, informed by a local banker that he had just been authorized by the National Bank of Scotland to advance a dollar a box on apples to be shipped to Glasgow at the rate of 5000 boxes per week, and it may be of interest to add that I have since seen boxes from this valley in shops at Edinburgh at just three times the price advanced on them in the cars at North Yakima. In further illustration of the profitable character of this industry, it may be worth while to quote a remark made by a fruit-grower in another of the irrigated valleys visited by us, that of the Rogue river, in southern Oregon, apples from which are, by the way, also to be seen at times in Edinburgh shops. It was, perhaps, in that valley that we experienced the crowning instance of the hospitality that was shown to us in America everywhere. We had gone to that valley in order to visit Crater lake, a lake at the distance of 80 miles from the small town of Medford, and 6000 feet higher up. The inhabitants of the town had collected 33 automobiles to drive us to the lake, and they came with us to drive us. It took them one day from their business in order to drive us to the lake, a second day they waited for our convenience, and on the third day they drove us down again. I should add that at Crater lake there are no hotels. There was a place where meals can be provided but without sleeping accommodation. Visitors sleep in tents. I afterwards learned, what I did not realize at the time, that all these comfortable tents were handed over to us visitors while the owners of the automobiles who had driven us up slept in their automobiles, under their automobiles, or anywhere. When one of us remarked upon their extraordinary kindness in doing so, the answer made was striking. "Oh," he said, "we make money so easily that we think nothing of it; we are glad to see you."

I have spoken of the comparatively few areas that present the necessary conditions for successful irrigation colonies, and in connection with this I should like to take this opportunity of noting a useful word which, so far as I am aware, Mr. Cooper has added to science. In giving an account of the various things one had to bear in mind in choosing a fruit farm he said, "There must not only be good water drainage, but good air drainage."

This latter term was new to me at the time, but I find it is already in use among meteorologists. But he added, "There must be no frost pockets." This term, so far as I am aware, is new, and an excellent term, it seems to me, to designate the fact which practical farmers become familiar with, although it is one that is concealed on maps that show us mean temperatures by isothermal lines based upon calculations supposed to reduce observed temperatures to temperatures at sea-level. The term "frost pocket" is a reminder of the fact that cold heavy air will flow downwards just like water, will accumulate in hollows, and thus make such hollows quite unsuitable for the cultivation of crops that are apt to be injured by cold.

Both in the Yakima and the Rogue river valley the irrigation conditions were somewhat simple. The last visit to which I shall call attention was to a region where we had gone to see the works constructed for irrigation upon an extensive scale. It was in the neighbourhood of Phœnix, Arizona, where provision is being made for irrigating about 170,000 acres by means of the Roosevelt dam. This dam has been constructed in the upper part of the Salt River valley so as to form a lake 25½ square miles in extent, and regulate the escape of the water into the river below.* Further down another dam has been erected so as to supply that water to irrigating channels in the flat and rich land round Phœnix, where irrigation has already been carried out on a smaller scale for a considerable time. The results of that irrigation were in many respects interesting, nothing perhaps being more striking than to see a great candelabra cactus growing up in the middle of an immense field of alfalfa. But the nature of the other crops was also interesting. Here for the first time we met with cotton, and here also some of us had the opportunity of visiting a date farm. Before reaching Phœnix I had been talking to Mr. Hanna, of the Santa Fé railway system, on which we were then travelling, about the cultivation of Egyptian cotton near Phœnix, of which I had heard, and the result of that was that when I was about to get into an automobile at Phœnix to drive up to the Roosevelt dam, a cotton-grower put into my hands a box of Egyptian cotton. Through the kindness of Dr. Dunstan, the director of the Imperial Institute, I have now got a report upon this cotton, which is described as "on the whole of good quality," but differing "somewhat in character from ordinary Egyptian cotton as grown in Egypt, although it would serve fairly well as a substitute for the latter;" a "clean soft" cotton "slightly lower in value than fully good fair brown Egyptian cotton," which is now (June, 1913) quoted in Liverpool at 9·8*d.* per pound. The price is important. It would probably be out of the question to attempt to grow here the ordinary upland cottons such as are sold at a much lower price. The labour costs in this out-of-the-way part of America would make that

* See "Progress in Reclamation of Arid Lands in the Western United States," by F. H. Newell, Director of Reclamation Service, in the *Smithsonian Report* for 1910, pp. 182-3.

unprofitable. Similarly with regard to the dates, we were informed that the cost of picking a pound of dates at Phœnix is as high as the cost of a pound of dates at a seaport in Algeria, and accordingly the only way to make date-growing profitable is to prepare a product of exceptionally high value by careful picking and packing, but when that is done a sufficiently high price can be obtained, it would appear, among the prosperous communities of the east to make its cultivation remunerative.

The continued prosperity of these communities is still maintained by the agriculture of the United States itself. Abundance of food for the rapidly growing population of that country is still afforded within its own frontiers, notwithstanding that the country no longer offers to any great extent the inducements for the propagation of wheat farming as the speculation of those possessing moderate capital. In the mean time, accordingly, those branches of agriculture connected with the supply of foods consumed by people of the temperate zone are not extending, but the United States, by diminishing its export, can still meet all its own wants. The extension of pioneer farming across the frontier, as well as elsewhere, has, however, the effect of restricting the cultivation of wheat and the associated crops within the United States. But the process of expansion in the United States, resulting as it has done of recent years in a large emigration of the agricultural population to Canada, inevitably causes us to look abroad and consider how long this expansion may still go on elsewhere. Considering how rapidly the United States have been filled up under pioneer conditions, it is difficult to see what part of the world will allow of a similar expansion going on for any long period. It would seem, accordingly, to be likely that the time is now approaching, even if it has not already arrived, when it will be necessary and will indeed be remunerative, to devote a greater amount of labour to the production of the foods consumed amongst the most advanced communities of the temperate zone. If that is so, the development that must go on in the future will be in some respects essentially different from that of the last half-century. What the precise nature of that development will be it would be impossible to forecast, but it may at least be hoped, that if it is slower, it may be in some respects healthier than that which we have experienced under the attraction and stimulus of cheap undeveloped land.

II. THE UNITED STATES NATIONAL PARKS.

By H. O. BECKIT, Assistant to the Professor of Geography, University of Oxford.

FACED with the geography of half a continent, as were the European guests who were invited to the notable celebration of the American Geographical Society's sixtieth anniversary, there is a difficulty which may well be called insurmountable in the way of any really full or adequate

account of the journey. In the first part of the report by the three R.G.S. delegates, Mr. Chisholm has dealt with some of the recent changes brought in the course of the exploitation by man of huge areas in the United States. It will perhaps be legitimate to devote a little space to the consideration of certain restricted regions which have been excluded from the scope of this sometimes rather ruthless process of exploitation.

In the National Forest Reservations, with the establishment of which Mr. Roosevelt's administration is generally and memorably identified, the Federal Government has assumed control, but with a motive primarily economic, of enormous tracts of land, mainly in the western half of the country. The needs of scientific forestry have resulted in the rapid building up of a great official service, to more than one member of which all the 1912 excursion party remain deeply indebted. Its work of necessity involves the preservation, at any rate in some degree, of primeval, natural conditions over the lands which it administers.

There are, however, other districts, much more limited in extent, but sufficiently numerous, which wise State interference, sanctioned in nearly every case by special Act of Congress, has deliberately and permanently laid aside "for the enjoyment and benefit of the people." Among these the National Parks of the West, whose position is shown on the first of the maps accompanying this article, are notable; but there is also a larger number of other reservations—about thirty—in the so-called National Monuments. These are usually smaller than the Parks, and differ from them somewhat in status as having been created by Presidential proclamation under the general authority of an Act as recent as the year 1906.

The National Parks are all managed through the Department of the Interior, which receives an annual grant of money for their regulation and upkeep; there is no special appropriation for the support of the National Monuments, but some of them have been put in the same care as the Parks, and the rest under the Secretaries of Agriculture or of War. They include areas of natural or scenic interest, and also prehistoric sites and historic landmarks. There is power to prevent vandal acts of spoliation, or unauthorized exploration; but for the National Parks a fuller administrative system prevails, having for its main object the preservation of natural conditions. What opening up has been done is by way of improving communications and making the various places of interest more accessible. Vegetation and fauna, for instance, are protected.

Though the immediate intention has been to save for the present and future generations great holiday grounds for the lover of natural history, scenery, or the out-of-door life, and that member of the public who is most directly catered for is the much-abused tourist, a real scientific end is served by the policy represented in the National Parks. To the geographer in particular they will always be magnificent object lessons in physical geography understood in its largest sense; and it is from this point of view that they will be treated here.

It was to be expected that the selection of these reserved areas should show some predilection for the unusual among natural phenomena, some preference of the curious before the more familiar but often really more interesting and significant. To the instructed mind this is a fault, but a fault, it may be added, of which a good many writers of text-books for our schools are guilty. It is still the fact that every one of these American parks has features that are interesting not merely because they are *bizarre*

or out-of-the-way, but by reason of their being highly characteristic examples of true geographical control, or of the interaction of inanimate and animate nature.

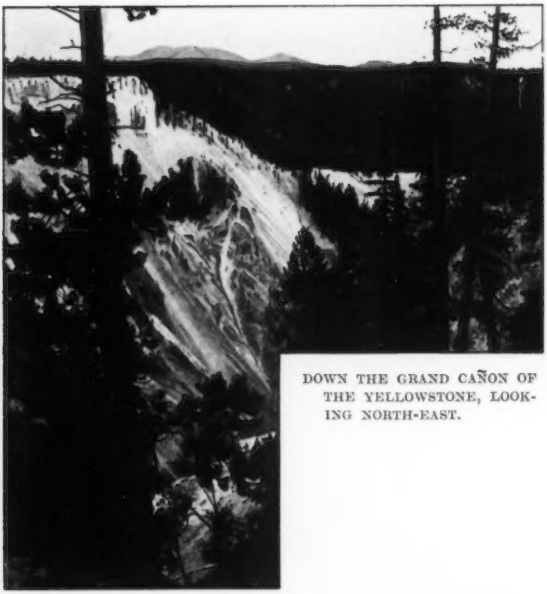
The opportunity to create reserved areas at all considerable in size can really occur only in new countries like the United States, where is much vacant land, and where the Government is itself a landowner on an enormous scale. The crown of geography may be, and no doubt is, its human aspect; but the questions with which it deals are admittedly of immense complication, probably more so than in any other subject. The preliminary analysis needful in rational study becomes so difficult that every aid is invaluable. What geographer, accustomed to the painful palimpsest of a

long-settled country, does not envy his fellow-worker in the newer lands? But even and indeed particularly in them, the processes of settlement and change work swiftly. At any rate for purposes of study, the elimination as far as is practicable of any single disturbing element, like man in his normal activities, must simplify the problem; and when most of a country has been developed by those normal activities, reserved areas where the pre-human stage is still observable throw light on much that lies beyond their boundaries. Reserves that are large enough to form in some measure complete entities, and not mere artificial, unnaturally bounded oases, will have a rapidly growing value for all nature students, and not least for the geographer, who, in attempting, for instance, to identify and delimit natural regions, is often working upon material which is more unreal than the meteorologist's map of isotherms reduced to sea-level—almost as unreal as that would be if the reduction factor were an unknown quantity.

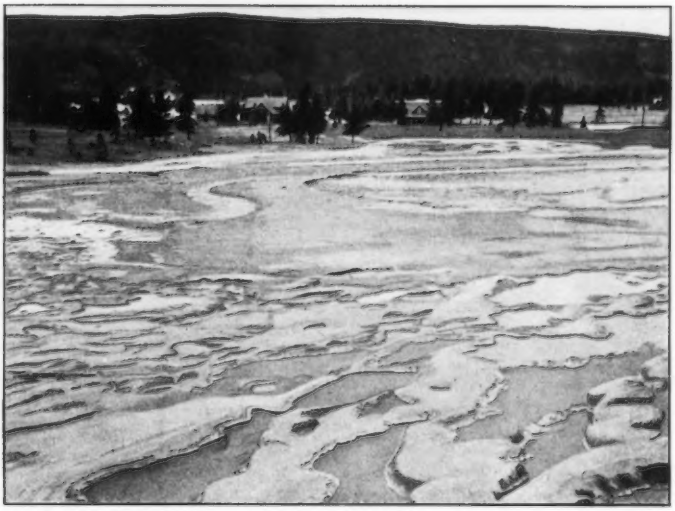
In the course of the excursion the party visited two of the Parks—the Yellowstone and Crater Lake—and three National Monuments. Little more than mention of the latter must suffice here: they were Muir Woods in the Californian Coast range, the Petrified Forest near Holbrook in Arizona, and the Grand Cañon of the Colorado. The last-named is probably too familiar for any compressed account to be useful: it was, of course, one of the great sights of the journey, and with Niagara, by no means fell short of its reputation for wonder or grandeur, or—something to the surprise of some of us, let it be added—for beauty. Apart from the way to it, the interest of the Petrified Forest was almost purely geological. The three hundred acres or so of Muir Woods were attractive, for one thing, by virtue of comparative smallness amid the big figures of a land where all seems vast. They lie nestling in a deep valley that reminds one of a Devonshire combe, just across the Golden Gate from San Francisco, and have giant redwoods that in contrast with the low scrub and grass on Mount Tamalpais, close by, form a living commentary on the effect of climate, modified by altitude and exposure. But this is a topic that is being more fully treated elsewhere.

Not merely in these natural reservations, but throughout its course, it is noteworthy that the excursion was directed largely though by no means wholly to facts and problems of physical geography. It is, of course, in this branch that most of the notable American share in the advancement of geographical science during recent years has fallen. As has been noticed by several observers, it is easy to see after a very brief acquaintance with the country how this has come about. Although Professor Davis and his energetic school are rapidly discovering endless complications of detail, the physiography in its main features is astonishingly simple. In a sense and in places it is monotonous, at any rate to an English eye, because a single key unlocks the door to so much at once—such large areas have essentially the same features. This seems to be partly because physical structure is fairly constant over wide ranges of territory, partly because

ABOVE THE FALLS OF THE YELLOWSTONE, LOOKING BETWEEN EAST-SOUTH-EAST AND SOUTH-SOUTH-WEST.



DOWN THE GRAND CAÑON OF THE YELLOWSTONE, LOOKING NORTH-EAST.



SINTER SLOPES OF OLD FAITHFUL GEYSER.

climatic, and accordingly physiographic, provinces are also large. What might seem to be a contradictory phenomenon, the sharpness of contrasts at least in the West, and the frequent narrowness or virtual absence of transitional margins, really conduces to the same result.

There seems to be in America at present a growing recognition of the value and importance of other branches of geography than the physiographic; but the movement is as yet young. There can be no question that the commanding influence that has been long and justly exercised by Professor Davis is the second, if not the main cause of his countrymen's past absorption in physiography; it was interesting and significant to find him several times urging, as he has for some years done both publicly and in private, that a great and worthy task lies before the young geographer of to-day in the systematic elucidation of the laws of biological, including human, geography. In different directions, and with varying scope, it may be worth while to point out that Miss Semple and Mr. Huntington, to mention two American names only, have already entered upon the work. This side of the subject will not be further dealt with here.

The second of the National Parks visited was that of Crater Lake in Oregon. It embraces great part of the outer slopes and actual rim of the caldera of an extinct volcano near the southern end of the Cascade range, and has an area of about 250 square miles. Here is to be seen on a grand scale the anatomy of a great mountain built up of lavas and volcanic tuffs, the products of long-continued eruption, and closely comparable with Mount Rainier or Tacoma (also a National Park) further north, and Mount Shasta to the south. Practically all the peaks which rise above the uplifted peneplain that constitutes the Cascades are indeed of similar origin. Rainier and Shasta still carry considerable glaciers: they were both seen, but from a respectful distance, during the excursion. Each of them reaches about 14,000 feet, but above Crater Lake the old top of the mountain has disappeared. It has either been blown away in a final eruption, or engulfed; the small amount of material remaining on the outer slopes that could be regarded as the *ejecta* of such a huge explosion makes the latter explanation more likely. A mountaineering club in Portland, Oregon, has given its name of Mazama to the complete mountain; but all that remains of its head is the great oval rim, for the most part from 7000 to 8000 feet above sea-level, descending by cliffs or steep screes to a lake about 5 miles in diameter and in places as much as 2000 feet deep. From its surface rises, close under the great western wall, an island formed of a perfect cinder cone standing on a very rough lava-flow, which together mark apparently the latest eruptive activity. Other parasitic cones and lava-flows diversify the rather gentle outer slopes of Mazama: these slopes have been much dissected, and on the south-eastern side two great valleys are cut right back through the rim, in which they form deep notches, trough-like in cross-section, and strongly suggesting beheaded glacier channels.

On the opposite side of the caldera, where the rim is almost at its highest,

a much older valley, similarly beheaded, has been filled by one of the later lava-flows; one can see in the cliff above the lake the whole layered structure, 1200 feet of newer dacite lying in a hollow eroded in the older andesites, and in places scarring the exposed face of the latter with numerous intrusive dykes. Similar old choked valleys occur at other points round the rim.

The greater lava-flows have all visibly been directed outwards from some point above the present lake: an exception in the case of a minor flow backwards towards the lake, with a striking little rift-valley near the edge of the rim above it, seems to be reasonably explained as an effect of the collapse of at least a large portion of the crown of the original volcano at a moment when the newest flows were still not thoroughly solidified. The general inference, again, is that the snowfields that fed the undoubted glaciers which once flowed down the outer slopes are to be sought, largely at least, in the higher vanished portion of the mountain.

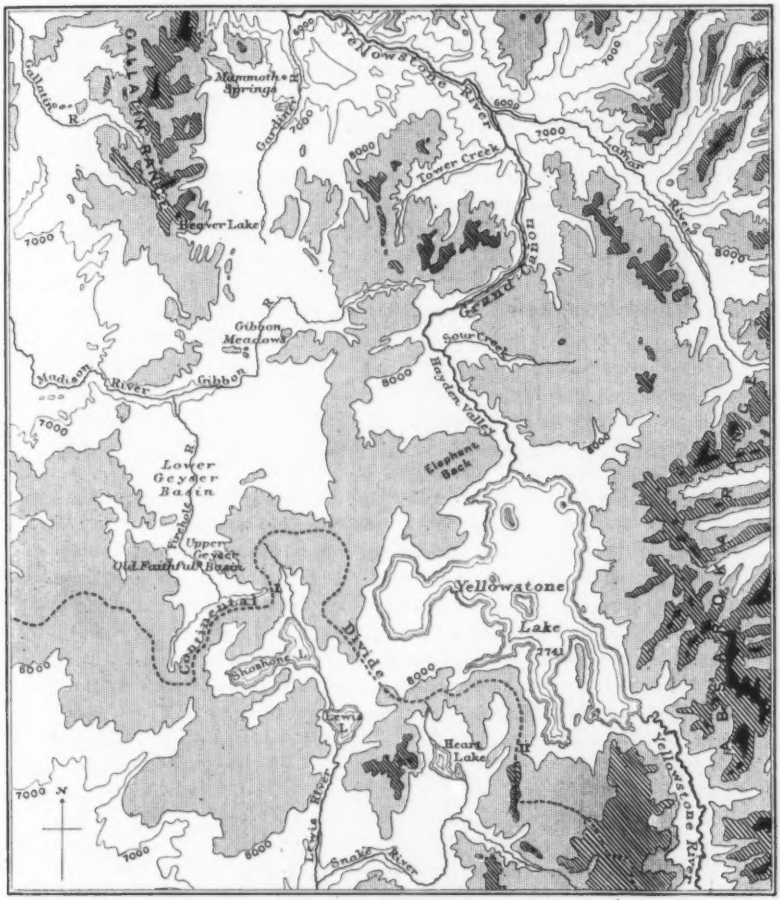
The surface of the lake now stands about 6000 feet above sea-level; at points somewhat lower on the outer slopes several streams rise, and others become more ample, as is evidenced in the deeper ravines which they have cut, frequently in ground of less slope. No doubt it is by such springs that the lake is drained and kept at a practically constant level.

The Department of the Interior publishes an illustrated pamphlet by J. S. Diller, of the U.S. Geological Survey, entitled the 'Geological History of Crater Lake.' Crater Lake is also one of the parks of which the topographic section of the U.S. Geological Survey has made a special map (scale 1: 62,500). As with all the parks, there is also available an annual report by the superintendent and a small pamphlet of general information for the visitor. These publications all sold at quite a nominal price.

For the Yellowstone Park there are official pamphlets, on the Geological History by Arnold Hague, and on Geysers by W. H. Weed, and a revision and extension to cover the whole park of four atlas sheets of the U.S. Geological Survey topographic map (scale 1: 125,000). This has contours at vertical intervals of 100 feet, and is the main source of the second of the two maps illustrating this article.

The Yellowstone is the largest and oldest of the National Parks. It lies at the north-western corner of Wyoming, with narrow strips to north and west in Montana and Idaho. Having been created as long ago as 1872, it had its boundaries laid down in an inevitably artificial manner so as to form as near as may be a rectangle something over 50 miles by 60, that is, about twice the size of the whole English county of Hampshire. The park is now almost completely surrounded by National Forest Reserves.

The almost innumerable geysers and hot springs are really only the signs of the last waning stages in a long volcanic history reaching right back into early Tertiary time. The excursion party spent a week in this park, entering and leaving at the north, and of necessity keeping quite close to the main roads built to link up the various basins in which the



YELLOWSTONE NATIONAL PARK Over 9000 feet.

showing

Relief, Main Rivers and Lakes

(From the U.S.G.S. Topographic Map)

Scale 1:750,000 or 1 Inch = 11·84 Stat. Miles

5 0 5 10 15

Reference

Feet.
10000
9000
8000
7000
6000

"fireholes," as the first explorers called the thermal springs, and the Grand Cañon, by which the river Yellowstone begins its descent toward the plains.

These basins are almost flat-floored depressions which lie nearer 8000 than 7000 feet above the sea, and are bounded by generally steep slopes leading to rolling upper plateaux or swells usually 500 to 1000 feet higher. Above these again rise, to north-west, north, and east, as well as in some smaller interior portions of the park, heights up to 10,000 or 11,000 feet. What remains appears broadly as a single tableland, across the south-west corner of which runs the continental divide (see map, p. 339) between the Missouri and Columbia river systems. Ambiguous drainage accordingly results at several points—for instance, that marked I on the map where the water in ponds beside the road between the Upper Firehole and the western arm of Yellowstone lake has an equally easy escape toward either ocean.

This tableland has been built up of very thick sheets of lava, mainly rhyolitic, and is simply the highest part of the Snake river branch of the vast Columbia lava-sheets, which cover altogether an area roughly twice the size of the United Kingdom. Were it not for these immense outpourings of igneous rock, the "Rocky mountains" in the latitude of the Yellowstone Park would, comparatively speaking, make default.

Crustal dislocations accompanied by great fractures seem to have opened the way for the lavas, and probably as a consequence of the extrusions, partial and irregular founderings took place and generally account for the enclosed basins and the swells of land which divide them. Previous to the long period of Territory instability the history of the rocks is one of quiet continuous sedimentation which gives, for example, in the Gallatin range in the north-west corner of the park, a conformable succession from Cambrian to Cretaceous. This range is parted from the depression along which the upper Gardiner flows by a great north-south fault, beyond which the ice-worn highland stands up as a *horst* or stable island rising from the solid waves of the sea of lavas surrounding it to west and south and east. These lava-sheets are themselves the upper surface of a series of somewhat tilted but broadly sunken blocks whose dip may be in any direction, but is prevailingly westward.

The Gallatins, like the snowy Absarokas which shut in the park on the east, are carved into Alpine forms, but their generally accordant summit-levels, in spite of diverse rock character, suggest that they are the still upstanding remnant of a larger down-worn area re-uplifted. The Absaroka range is mainly sculptured out of volcanic breccias somewhat older than the plateau lavas, and these have partially filled some of the earlier valleys carved in the breccias.

Another result of the fractures has been to further percolation of surface water, aided by the work of solfataric gases which have decomposed the rocks to an astonishing depth, and at the Cañon, in particular, gloriously coloured them. The percolating water becomes charged with mineral matter in solution, and returning to the surface by geyser or ordinary spring

BEAVER LAKE FLAT, UPPER GARDINER RIVER.

ACROSS THE YELLOWSTONE CAÑON, LOOKING NORTH.

action redeposits either travertine from the limestones, as at Mammoth Springs (see map, p. 339), or sinter from the rhyolites themselves. It is natural to find most of the springs occurring in and especially near the edges of the foundered blocks, as at the lower and upper Geyser basins (again see map) along the Firehole river.

One of the accompanying photographs shows some of the detail of a low sinter cone around Old Faithful, the best known of the park geysers; the low mound in the middle distance at the left is of similar origin. The surface drainage can be seen winding round these obstructions set up in its way. Both in this view and in that taken at Beaver lake near the head of the Gardiner, the higher forest-clad swells may be seen rising characteristically above the aggraded basin floors; in the second of the two views the aggrading process, however, is the normal one of lake and stream deposit. A typical case of such a normally aggraded, probably tectonic hollow forms the Gibbon meadows.

The three remaining photographs were taken either at or quite close to the brink of the upper Yellowstone cañon, not far from its head (a little north of the initial S in the name Sour creek on the map). In the southward panoramic view the meandering stream in the foreground is Sour creek, flowing south-west in a wide depression that was perhaps once that of the main river, to join the Yellowstone, which can just be seen in the distance towards the right. The view down the cañon shows the strong contrast between the steep-walled gorge and the even surface of the plateau, above which only occasional hills or mountains rise. Reference may also be made to two of the illustrations (Figs. 5 and 6) in the article by Mr. Ogilvie which follows.

The cañon itself, whose erosion is proved by drift deposits outcropping in places at the top of its walls to be not older than late Pleistocene, and possibly even more recent, is entered by the river over two falls, the upper one 100 and the lower 300 feet high, formed by rock bars stretching across the gorge. These might at first sight be taken for dykes, but really are merely sound portions of the same lava that elsewhere has been so weakened by the chemical decomposition already referred to as to have permitted, in a "fraction of post-glacial time" according to Professor Goode,* the erosion of a gorge between 1000 and 2000 feet deep. The stream-bed at the bottom of the cañon is still ungraded. According to Goode, we have here a pirate stream, a sort of second Tower Creek (see map), which has worked back until it began to draw off the waters of Yellowstone lake, then probably held up by ice or drift from its natural escape towards the Snake river so as to flood Hayden valley and reach, as actual deposits show, to the present position of the head of the cañon. Near the southern arm of the present lake, at the point marked II on the map, a steep-

* "The Piracy of the Yellowstone," in *Journal of Geology*, vol. 7 (1899), part 3, pp. 261–271; reprinted with additional illustrations in *Bulletin of the American Bureau of Geography*, vol. 2 (1901), part 2.

sided channel, evidently not long abandoned by a powerful stream, cuts across the Divide. The withered stream in its western half was named by the surveyors Outlet creek, in the well-grounded belief that this was at least for some time the path by which the lake waters escaped. An indefinite divide, midway in it, is little, if at all, more than 8000 feet above sea-level, perhaps even lower.

The accession of water from the lake enabled this once small stream, originally a tributary of the Lamar river, to dig most of the cañon, not as at Niagara by the backward recession of a waterfall, but more probably by simultaneous erosion all along its length.

The Yellowstone lake itself occupies the largest of the tectonic basins in the park, and is surrounded by lacustrine silts to a height of about 100 feet above its present surface. At least two strand terraces can be traced in these and in the glacial drifts underlying them, and mark separate stages in the drawing off of the lake waters. The underlying drift suggests that the whole basin, but not the higher plateaux to the west, was overridden by ice which gathered here from snowfields to east and south.

Though fishing is permitted with certain restrictions, complete protection is otherwise given to the *fauna;* none are killed unless of species, like the coyote and the puma, destructive to the rest, or individuals which become dangerous to visitors. Besides the bison, four kinds of deer, two or three of bear, and the horned mountain sheep, there are many smaller animals, especially rodents; the beasts are often so tame as to be easily observed in this their natural habitat. Some of the fish have been introduced by man; at least one species is a most significant natural immigrant to the upper Yellowstone from across the continental divide. Because of its altitude, there are at any rate no rattlesnakes in the Yellowstone Park.

III. IMPRESSIONS OF THE VEGETATION IN THE UNITED STATES OF AMERICA.

By ALAN G. OGILVIE.

As this century advances, long and rapid journeys are becoming more and more common. A few years ago it would have been considered ridiculous that a party of people should set out to cover 14,000 miles in two months, with the object of seeing the country through which they passed; and even to-day it might reasonably be asked, What lasting impressions can be formed on such a journey? The American Geographical Society of New York last autumn gave to its European guests an opportunity to find the answer to this by experiment.* Since such opportunities must necessarily come to an increasing number of people, it will be useful to see how the geographer may best profit by what he sees on a journey of this kind.

* *Geog. Journ.*, April, 1913, p. 349.

In the first place, the traveller may scrutinize the landforms, and in a general way he may assign them to their proper position with regard to rock composition and structure, to process and stage of erosion; but into the details of the development of surface relief he cannot go. Secondly, he may observe, superficially at least, the direction which human activity has been forced to follow by the nature of its geographical environment. From this he may form some opinion regarding the climates of the country. It is, however, impossible for most people to make a study of climate in a journey of this character; yet it should be noted that one who already has a sufficiently comprehensive knowledge of the climatic details, may give their true significance to the weather phenomena which he observes on the journey. This has been clearly proved by one of the Transcontinental Excursion party, Prof. R. de C. Ward, in two papers.* In the case of most men, whatever they gain in knowledge of climate from personal observation must come indirectly from examining the kind of agriculture practised, and above all from a systematic watch upon the character of the vegetation.

However attractive and even fascinating are the other aspects of the journey, the following notes are restricted to the main features of the vegetation observed in the course of this admirably planned journey. The relations of the vegetation to climate, relief, and soil will be kept in view throughout.

In reviewing the vegetation of a country it is essential to remember the following principles.† The type of *vegetation* in tropical and temperate zones is determined by the rainfall, by the humidity of the air, and by the movements of the air—the last being important as a desiccating agent.

The type of *flora*, so far as it is determined by existing factors, depends primarily on *heat*. The finer differentiation of vegetation and of flora within a climatic district is chiefly determined by the chemical and physical composition of the soil.

In the first part of this paper the writer will give a brief sketch of the more general features of vegetation and of the changes, sudden and gradual, in its character. In the second part four districts will be dealt with in greater detail. Reference should be made to the two maps, on which the route is printed.

From the Atlantic to the Pacific.

The Western European does not experience any very strange sensations in travelling through the North-Eastern United States. Landscapes do not differ greatly from those in Europe. The journey up the Hudson and Mohawk valleys to Lake Erie can be passed over briefly; for while it was largely through forests of extraordinary beauty, and along streams

* R. de C. Ward, (1) *Journ. of School Geog.*, 1913; (2) *Monthly Weather Review*, December, 1912, p. 1909.

† See Schimper, 'Plant Geography' (Oxford, 1903), p. 159.

bordered with a rich carpet of wild flowers, the general character of its deciduous trees was familiar, and impressions will therefore be omitted. For the same reason, as well as from the hurried nature of the final stage of the homeward journey, the Appalachian region will not be described.

The early morning of the sixth day out found the party at the south end of Lake Michigan, confronted by a range of high sand-dunes of great interest. They are at various stages of development, from the young unfixed dunes with no vegetation, some of them nearly 100 feet high, through all stages of fixation by such plants as bent grass and a dwarf willow, to the old or fossil dunes, covered with well-established oak woods. The form and size of the young dunes tell us of the force and direction of the off-lake winds of Michigan, while the evident rapid undercutting of the oak-covered dunes by the waves remind us of the size of these great bodies of water, and of the storms which can rage upon them.

The route brought us from Central Wisconsin * to the Mississippi, and up that river to St. Paul. The varied deciduous woodland lent a richness to the wide flood-plain, while the steep bluffs were clothed by shrubs and creepers in great variety, amongst them the sumach and wild grape vine. The change from this rich valley to the muskeg swamps of Minnesota was as complete as it was sudden. Not only were we steadily travelling to regions of more rigorous temperature, but we had passed from a non-glaciated tract by way of a mighty river-valley to a region bearing all the symptoms of glaciation. The vegetation corresponds to these climatic and physiographic conditions. The journey from Duluth with its ice-scoured hills northward to Hibbing was mainly through a dreary waste of innumerable pools amid sphagnum bogs, the result of the ill-defined drainage of this drift-covered plateau. On this surface was an open forest, chiefly coniferous—white pine (*Pinus strobus*), Norway pine (*Pinus resinosa*), white spruce (*Picea alba*), and tamarack (*Larix Americana*), but with birches (*Betula alba*) and aspen (*Populus tremuloides*) interspersed.

A night journey from Duluth brought us again into another type of vegetation. The passage westward from the boulder clay and moraines to the bed of the huge glacial lake "Agassiz"—now marked by the basin of the Red river—corresponds to the transition from forest to prairie. Here are the richest grass lands and the most valued farming country of which Fargo is the centre. The woodland, mainly aspen, is confined to the valleys. A journey of some 200 miles from Fargo brought us to Bismarck, on the Missouri. It lay over country which became steadily more broken. The only variation to the expanse of grass was the numerous ponds—presumably of glacial origin—many of which were nearly dry, and showed the most beautiful zoned arrangement of plant associations round their margins. At Bismarck the fact that the steppe consists not merely of grass, but of grass with a considerable admixture of sage brush (*Artemisia tridentata*) and atriplex, is a sign of decreasing

* See below, p. 351.

moisture. Moreover, the following day at Medora, on the Little Missouri, 100 miles further west, the sage brush was found to be mingled with a dwarf cactus (*Opuntia*) and the grass was very scanty. This 300-mile journey across North Dakota, in fact, corresponds to a drop in annual rainfall from 24 to 14 inches, or to a change from rich meadows to semi-desert, from wheat farms to horse ranches.

A long day spent in the saddle enabled the riders to form a clear idea of "badland" topography about the Little Missouri. The extreme dissection of the plateau and the fine texture of the ravining is due largely to the absence of vegetation. The slopes, in fact, are mostly of bare clay. The flat tops of the hills have scanty grass, sage, and cactus; in the gullies stunted juniper trees are scattered. Some of the wider and deeper valleys —dry at this season—were covered with fine green turf, forming rich pasture for the herds of horses. The banks of the Little Missouri are well wooded, mainly with aspen and ash.

The climb along the Yellowstone river took place at night, and the morning saw the train well within the confines of the Rocky mountains. A digression was made from this point to the Yellowstone Park.*

The forests of the Western States are confined to the mountains except in the extreme north-west. As the relief increases, so do the contrasts of rainfall, with the result that the chief feature of the vegetation now to be seen was the frequent and sudden changes from forested slopes to treeless plains. The other main point to be noticed is that these western forests practically consist of coniferous trees. The continental divide was crossed by a low pass, and for the next 300 miles the train ran north-west through intermont depressions, narrow valleys, and wide basins. On the left were the Bitterroot mountains, densely wooded on the higher slopes, for they probably receive over 40 inches of rain, though the only tree which creeps low enough down to the more arid valley to be recognized is the yellow pine (*Pinus ponderosa*). The western slopes of the Rockies proper, which lay on the right, are here in the rain shadow, and it was very striking to observe their forest caps sending their fingers of trees down every little gully, while the sharp spurs between bore stunted bushes on their northern sides, but were entirely bare on those parts facing the sun. This phenomenon becomes very familiar to the traveller in the Western States.

As we crept round the northern end of the Bitterroot mountains, it became obvious that a tongue of the great Pacific forests was here thrust out to the east. The valleys bore trees to the bottom, mainly yellow pine, with the western white pine and larch higher up. The grandeur and solitude of these forests of northern Idaho is most impressive, and it comes as a surprise to see in their midst an evidence of man in the great stores of lumber floating upon the Pend d'Oreille lake.

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* See below, p. 352.

Again a night journey hid from us the transition to a fresh vegetation. This time a drop of 1500 feet in altitude, and of some 15 inches of rainfall, caused the change. The result is a sage-brush landscape, where it has not been replaced by skilful dry farming. There is an interesting variation, however, to this *Artemisia* formation in the bottom of the gorge left by the Columbia river—the Grand Coulee. Here the soil is charged with alkali salts, and there are even some salt lakes remaining. The *Artemisia* of the plateau gives place to a greasewood formation, with greasewood (*Sarcobatus vermiculatus*) and *Atriplex hastata*.

The last section of the westward journey is perhaps the most interesting, for it plunges the traveller suddenly into one of the most luxuriant forests of the Earth. The passage from the Yakima valley over the Cascade mountains to Puget sound must surely be one of the most remarkable journeys of its length which can be made. The sage-brush and the aspen valley woods give place to yellow pines, small at first, then larger. The yellow pine is not a tree which likes moist situations, and on these lower eastern slopes, in fact, the rainfall is small, while *chinook* winds increase the evaporation.

As the low pass (*circ.* 4000 feet) draws near, the Douglas fir (*Pseudotsuga Douglasii*) and lodgepole pine (*Pinus Murrayana*) are also seen. The dense forest covering of the mountains overhangs a group of finger-like glacial lakes, and from time to time a snowclad peak overtops all. Once over the crest, and still greater luxuriance meets the eye. The Douglas firs become huge, and they are mingled with the white cedar (*Libocedrus decurrens*), a gigantic tree, in habit like the deodar, but much darker in colour. Everywhere a dense, moist undergrowth speaks of the humid climate. The material for the accompanying diagram (Fig. 1) is supplied

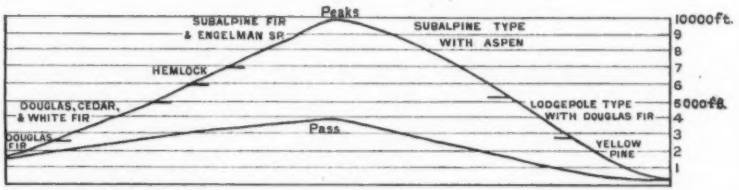

FIG. 1.—DIAGRAMMATIC PROFILE IN THE NORTHERN CASCADE MOUNTAINS.

by statistics which exist for the belt just to the north of this pass. The diagram may therefore be taken to show approximately the forest conditions in this section of the Cascades.

The forests about Puget sound are magnificent where not destroyed. Many of the trees of the Cascades occur, among which the Douglas fir predominates, the gigantic red cedar (*Thuya gigantea*), while variety is given by the madroña (*Arbutus*) and other deciduous trees.

Southward to California.

The description given below * of the vegetation of the Crater Lake region may be taken as typical of the greater part of western Oregon. The first feature of change in the vegetation observed on this southward route was that due to the decreasing humidity in northern California. Mount Shasta, which guards the northern gateway to the state, stands alone, a veritable queen of the west, an ice-clad cone with a garland of forest draping the glacier tongues. The traveller, spellbound by the sight, may well forget to note the foreground of the picture—a landscape of tumbled cinder cones, bare of all vegetation save some scattered junipers and stunted pines and a thin grey carpet of sage-brush. It is the foreground which gives the keynote of Californian vegetation and climate—the long summer drought. This is firmly impressed on the observer as he makes his way southwards to San Francisco through the wide and treeless Sacramento valley, now all under cultivation. A day amongst the vegetation of the vicinity of San Francisco bay is enough to convince him that the rainfall period coincides with the low temperatures, and that the hot summer is also a dry summer. The view from Mount Tamalpais (2600 feet), overlooking the bay, will never be forgotten. As far as the eye can reach, the hills—except for certain slopes bared by fire—are clad in a mantle of scrub, resembling nothing more than a thick-piled carpet of wonderful colour scheme, comprising all tints from gold to deepest green. The writer was reminded of an autumn view of the forest-clad waves of the Vosges, where the treetops formed the carpet. But the difference was seen when the eye rested on the damp valley bottom to the west, where the stunted nature of the cover was shown up by contrast with full-grown woods—maple, bay-tree, and, towering over all, the giant Californian redwood (*Sequoia sempivirens*).

An excursion into this sea of scrub, or *chaparral* as it is called in America, showed that it contained a great variety of species, from 3 to 5 feet high, of all tints from the dark olive-green of the sticky-leaved yerba santa (*Eriodictyon tomentosum*) through many glaucous shades, such as the greasewood (*Adenostomata fasciculatum*) and the manzanita (*Arctostaphylos glauca*) to the brilliant yellow of the golden fleece (*Bigelovia*) shaped like an inverted cone and covered with flowers. The chaparral is composed almost entirely of sclerophyllous plants, and, but for the redwood trees in the valleys, the landscape might be on the shores of the Mediterranean, a region corresponding in latitude and climate alike.

Eastward to the Great Plains.

The cross-section which was followed in the return journey over the western Cordilleras differed in several important respects from that followed

* See p. 354.

on the outward route. In the first place, it lay, on the average, 450 miles farther south; next, its length was much greater—roughly 900 miles as the crow flies, as against 600 in the northern part; and thirdly, the ranges are here at their highest and most massive part. The stretch from San Francisco to Denver may be analyzed into the crossing of Sierra Nevada on the west and the Sawatch mountains—as the main divide of the Rockies is called here—on the east; secondly, the traverse of the Great Basin and of the upper parts of the Colorado plateau; and thirdly, the journey along and through the Wahsatsch mountains which separate the last two. As there were many features of similarity in the two great mountain ranges crossed, they will be dealt with together.

The route over the Sierra Nevada was by the Yuba river (south fork) to Donner pass (7100 feet) and down the Truckee river, which drains to the Great Basin. The Sawatch were crossed at Hagerman pass (11,500 feet), reached by the valley of the Gunnison river, which drains to the Colorado river, while the descent was made to the basin of the Arkansas rivers. In both cases the mountains had been glaciated, and in both a long ascent in a trough-like valley led to a wider and nearly flat stretch of high meadow on the west side of the pass. In each this was in strong contrast to deep and steep corries of bare rock, and to moraine-dammed lakes on the eastern face. In the case of the Sawatch, lateral moraines stood very high on the sides of the western valley, and by damming back streams had produced lakes, now marked by damp pastures.

The Sawatch are considerably higher than the northern Sierra Nevada, but it must be remembered that the latter are high enough to extract much of the moisture from the west winds, so that the rainfall at Donner pass is probably much greater than that at Hagerman.* The greater altitude must ensure lower temperatures, however, and on the east side of the Hagerman pass the glaciers have left a relic, in the form of a patch of stratified *névé*.

The zones of vegetation were interesting in the two cases. First, in the Sierras. The dry foothills are covered with oak and mixed scrub, and the first conifer to appear is the small digger pine (*Pinus sabiniana*); in the scrub the manzanita (*Arctostaphylos glauca*) predominates. About 4000 feet the oaks were left behind, and the yellow pines which had succeeded the digger pines were joined by the Douglas fir. About 5000 feet this was replaced by the white pine (*Pinus monticola*) which, with the yellow pines, continued as a scattered growth right over the pass and down the eastern slope.

In the Sawatch the yellow pine and its companion, the Douglas fir, are left behind in the valley at 7000 to 8000 feet. From 8000 feet to 10,000 feet the Engelmann spruce predominates, and above that a subalpine

* From Sacramento with 19·9 inches to Summit with 46·9 inches is an increase of 27 inches. In the case of the Sawatch, no statistics have been found for the Hagerman pass.

fir (*Picea lasiocarpa*) which reaches the summit in a stunted and scattered growth.

The abrupt eastern slopes of both ranges have at their foot similar treeless depressions, which provide much good pasture. In the Rockies these are called "parks," and the party, on descending into South park, had a foretaste of the Mexican flora in the piñon pines (*Pinus edulis*) and yuccas (*Yucca angustifolia*) of the foothills round its margin.

There are two features of the Great Basin which make a great impression when seen for the first time, and the vegetation plays an important part in producing the impression. One is the salt desert, and the other the mighty scarp of the Wahsatch mountains overlooking it on the east. The two great depressions, once filled respectively by Lakes "Lahontan" and "Bonneville," are now areas of semi-desert and desert. Slight changes only may be discerned in the vegetation over wide tracts, according as the area is (*a*) intensely alkaline, (*b*) arid without being alkaline, or (*c*) slightly less arid. The less arid type is found on the mountains, which rise in isolated groups throughout the basin. Their slopes are nearly bare, and are scored with dry gullies, but a scattered growth of juniper (*Juniperus Californica*) can sometimes be seen. The more arid tracts are grey-green in colour, with an open sage-brush formation (*Artimesia tridentata* and *Atriplex canescens*). Lastly, the most striking of all are the lowest parts with their glistening white salt-fields sprinkled over with clumps of xerophilous salt-loving plants, sometimes pale green, sometimes tinged with red (*Salicornia herbacea, Sercobatus vermiculatus, Spirotachys occidentalis*).

The Wahsatch escarpment presents a bold front, broken only by narrow gorges. To leave the flat colours of the desert and plunge into the verdant cases of irrigation about Salt Lake City is indeed refreshing to the eye. Of forest trees few remain on the western slopes of the Wahsatch. On the crests pine forests were visible, and, before the settlers came, they must have extended lower. The sight of the clouds collecting on the slopes and remaining there all through a hot day, made one feel sure that the conditions are suitable for forest growth. The Wahsatch canyons were indescribably beautiful. The plashing streams were bordered by box-elders and aspens, while the September frosts had given the most brilliant hues of scarlet and orange to the maple and scrub-oak on the slopes.

The journey southward and westward to southern Arizona was full of interest from the point of view of vegetation. The European traveller is made to feel that he is surely entering the strangest part of the continent. The increasing number of Indians, the ancient architecture, native and early Spanish, and most of all the changing flora, combine to produce this effect. Part of the transition area will be described below.* The deserts

* See p. 355.

and semi-deserts have recently been described in the *Geographical Journal* by two leading authorities, * and a few words must suffice here to describe the landscape of the intensely interesting region crossed in travelling (by motor car) from Phœnix to the Roosevelt dam.

The first impression on detraining in the "desert" is one of disillusionment, for, quite apart from the irrigated fruit gardens, the natural vegetation of these outwash plains appears to be incomparably more luxuriant than that of the Great Basin (Fig. 2). It is true that the general tint is a glaucous green, but the variety of species, of form, and—within limit—of colour is very great. A hasty examination, however, shows that the covering is by no means closed, the soil being quite bare often for several square yards. Moreover, the plants are all extremely xerophilous, and the great variety above mentioned is due partly to the differences in the nature of the means for withstanding drought, with which the plants are provided. The greater number are either sclerophyllous or succulent. Of the first class the creosote bush (*Covillea tridentata*) is the commonest. It provides the darkest green to the landscape; its leaves are small, pointed, leathery, and sticky. The richest green as well as the most graceful form is that of the palo verde (*Parkinsonia microphylla*), a small feathery tree with minute leaves and a bright green bark. This and the mesquit (*Prosopis*), with an acacia (*Acacia greggii*), are the only trees, having anything like northern tree form, which were seen in the region, except certain broad-leafed species along the river-banks.

Only a few of the succulent plants can be described here. On the plain cacti of many species were intermingled with the other shrubs; the giant cactus (*Cereus giganteus*) dominates everything, but for beauty of form and tint there is none equal to the *Opuntia fulgida* and the *Opuntia Bigelovii*, with their dense armament of silvery spines, while the prickly pear (*Opuntia ficus indica*) is the most quaint in shape. The 100-mile motor journey into the mountains and zones of greater rainfall was marked by ever-changing vegetation, either species altering or the density and general habit changing. The giant *Cereus* seemed to get more and more contorted and unearthly as we went on, the graceful occatilla (*Fouquiera splendens*) appeared, its long whip-like stalks radiating from a point and bearing scarlet flowers. The thick-leafed agaves and yuccas, many of them bearing the high flower stalks, completed the picture.

Eastward to the Mississippi.

A rapid, unbroken journey of 2½ days brought the party to the Mississippi at Memphis. In approaching the river the line runs through magnificent and varied forest, both conifers and hardwoods being present. White oak (*Quercus alba*), a hickory (? *Carya amara*), and a cypress

* D. T. MacDougall, *Geog. Journ.*, **39**, pp. 105–200, "North American Deserts;" C. Lumholtz, *Geog. Journ.*, **40**, pp. 503–510, "The Sonora Desert."

FIG. 2.—SEMI-DESERT NEAR PHŒNIX, ARIZONA. *CEREUS GIGANTEUS, OPUNTIA FULGIDA, PARKINSONIA MICROPHYLLA, COVILLEA TRIDENTATA.*

FIG. 7.—FOREST OF SUGAR PINES (*PINUS LAMBERTIANA*), NEAR CRATER LAKE, OREGON.

FIG. 6.—UPPER GEYSER BASIN, YELLOWSTONE PARK. LODGEPOLE PINE (*PINUS MURRAYANA*).

FIG. 4.—FALLEN TREES (*PINUS MURRAYANA*), YELLOWSTONE PARK.

FIG. 9.—TONTO PLATEAU, GRAND CANYON, ARIZONA. *COLEOGYNE RAMOSISSIMA*, *PROSOPIS*, *OPUNTIA FICUS INDICA*.

FIG. 8.—SOUTHERN RIM OF GRAND CANYON, ARIZONA. VIEW OF WOODLAND FROM A FOREST WATCH-TOWER.

(*Taxodium distychium*) appeared to be dominant. A steamer voyage of 70 miles downstream was most impressive, but chiefly from its extreme monotony, one bend of the river appeared exactly like another; the richly varied forests could not be seen, as they were hidden by a dense growth of poplar (*Populus monilifera*). The growth of vegetation is undoubtedly rapid here, but so is its destruction. The river, in fact, is constantly undercutting its soft tree-clad banks. Many times throughout the 70-mile journey large sections of bank, generally bearing one or more trees, were seen to slip into the river.

From the Mississippi a hurried journey through the Appalachians, and the return to New York after a four days' halt at Washington, brought the excursion to a close.

Central Wisconsin.

At Camp Douglass, a point 90 miles north-west of Madison, the railway emerges from valleys cut in sandstones to a wide flat plain, from which those strata (the Potsdam series) have been removed by denudation. The transition from one area to the other is marked by a number of isolated and rocky buttes, the outliers of the sandstone. The summit of one of these afforded a wide view (Fig. 3), and the forest features which were

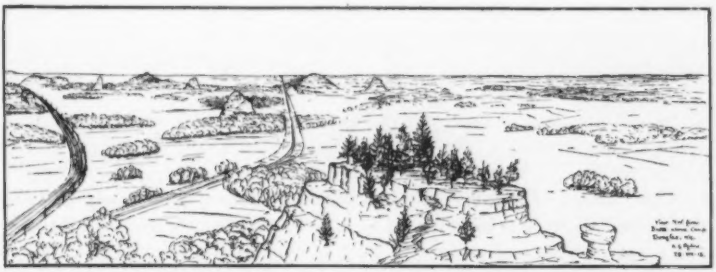

FIG. 3.—VIEW NORTH-WEST FROM A BUTTE AT CAMP DOUGLASS, WISCONSIN.

prominent in it tempted reflection upon the probable history of the different vegetation types, and the probability that each is inherited from a different climatic period.

Camp Douglass stands in that triangle of country—the "driftless area"—which, alone in Eastern Canada and the North-Eastern United States, was never covered by the ice-sheet. The ice, however, was near enough to give it a boreal climate. Then, as the ice retreated, swamps took its place. Farther north these swamps can be seen to-day, and the tamarack (*Larix Americana*) still found in this area is a relic of this stage. As the climate improved, drier forests, mainly coniferous, extended over the whole region, and these in turn were ousted from all but the more inhospitable situations by the deciduous forests spreading from the south-east as warmer conditions supervened. In the vicinity of Camp Douglass

FIG. 8.—SOUTHERN RIM OF GRAND CANYON, ARIZONA. VIEW OF WOODLAND FROM A FOREST WATCH-TOWER.

the less hospitable situations are represented by the sandstone crags, whose stunted white and Norway pines (*P. strobus* and *P. resinosa*) are relics of a once continuous coniferous forest, such as is found to-day farther to the north.*

But in the district we are considering the plains, as far as the eye can reach, are covered with deciduous forests, in which the oak is dominant, broken by tracts of grassland. It would seem, in fact, that this is one of those regions in which deciduous forest and prairie struggle for mastery. There is, undoubtedly, sufficient rainfall for an open forest, and we may presume that it existed formerly, but, being partly destroyed by fire or other cause, it gave place to the thick prairie sod which established itself in the district. Without the aid of erosion to break this soil cover, the forest was unable to recover the lost ground. Thus it is that a map of the vegetation of the United States (see map) shows the meeting of three main types in central Wisconsin—the mixed temperate forest, in which conifers predominate, and of which the hilltop pine woods just referred to are outliers on its south side; the deciduous forest adjusted to warm temperate conditions; and, finally, the prairie, which in its eastern parts may well be called "park steppe," from the fact that the grassland has isolated tracts of woodland throughout.

Yellowstone Park.

The Yellowstone Park occupies a high lava plateau in the eastern part of the Cordilleras. Its altitude varies from 7000 to 9500 feet, but the greater part is between 7000 and 8500 feet. It is bordered on all sides by higher mountains, which are snow-clad for most of the year.

This plateau is reached from the north by a long and steady ascent, while the Yellowstone river leaves it on this side by two great waterfalls and a deep canyon. From the isolation of the plateau, it is to be expected that the vegetation will be rather special in character; but the traveller, as a rule, is unprepared for the monotony which is the most striking feature.

The dry conditions of the great plains are continued up the valley of the Yellowstone river to the Park. Except for the woods of aspen and willow fringing the river, the valley is everywhere a steppe. The spurs in many places, even at the height of 5000 to 6000 feet, bear vegetation only on their north-facing sides. Mammoth Springs (alt. 6300 feet), near the north edge of the park, is considerably below the level of the tableland; but the annual rainfall is 19·6 inches,† and the plateau vegetation may be said to begin here. Variety of scene throughout the circuit of the plateau

* The writer's attention was called to this fact by Prof. H. C. Cowles, of the University of Chicago.

† Henry, 'Climatology of the United States.' *Bulletin* Q, U.S. Weather Bureau.

is derived entirely from the physiography—the geysers and geyser-basins, the lake, and the canyon: the vegetation, as stated above, is interesting chiefly because of its monotony. It is a dense pine forest, in which practically one species alone is represented, the lodgepole pine (*Pinus Murrayana*). The areas which are not forested are, first, the valleys and depressions filled with glacial drift, river alluvium, or lake-deposits; and, secondly, the vicinity of the geysers and hot lakes.

The lodgepole pine is the tree characteristic of the drier plateaus of the Rocky mountains, and it never grows to a great size. In the Yellowstone the stands of trees are generally very dense and without undergrowth; but even where they are open the woods are difficult to penetrate, on account of the number of fallen trees. The Yellowstone Park is purposely left in a state of nature, and to one who has never seen a great forest untouched by man, these pine woods are of the greatest interest. Trees, dying a natural death, fall and slowly decay; others fall across them before their decay is complete, and a tangled mass of fallen trees, in many places quite impenetrable, is everywhere to be seen (Fig. 4). The timber is in all stages of decomposition, and often a long moss-covered ridge, or even a mere strip of richer soil, marks the spot where a tree has been resolved

FIG. 5.—THE PLATEAU OF YELLOWSTONE PARK FROM OBSERVATION PEAK; ABSAROKA MOUNTAINS IN THE BACKGROUND.

into its elements. This condition of the forest is a source of grave danger to the living timber, and the wisdom of allowing it to continue, in view of the risk of fire, is now being discussed. A peculiar quality of the lodgepole pine is that it is the only pine whose seeds remain alive after a mixed pine forest has been burned. For this reason the lodgepole tends to grow over all burnt areas in the interior mountains of the States. On some of the higher slopes in the Yellowstone (at 8500 feet on the continental divide) Douglas firs were seen, and it seems possible that they were relics of a varied coniferous forest. If such be the case, the monotonous lodgepole forest may owe its existence to fire.

The view south from Observation peak (9300 feet) (Fig. 5) showed up the contrast of the forested lava-sheets and the grass-covered drift of the valleys. These meadows have a rich carpet of flowering plants and grasses, and there is much bog. In many cases, although the streams meander over their surface to-day, the old lake-bed and its meadow or bog cover must

sooner or later be eroded when the old lip of the lake has been sufficiently cut down. The area may then be expected to become forested.

The Upper Geyser basin (Fig. 6), as seen from the top of the precipitous rim 800 feet above it, presents, perhaps, the most varied picture to be seen on the plateau. The surface is dotted with snow-white cones and circles of sinter, bare of all vegetation. In the centre of each circle is either a steaming vent or else a hot lake of the most wonderful blue or green tints. The higher parts between the geysers and streams are tree-clad with lodgepole pine, but the trees thin out as they approach the sinter. Everywhere trees are killed as they stand, and other signs bear witness to the encroachment of the sinter or the hot and alkaline waters. The rest of the basin is filled with the alluvium of the Firehole river. But here again is a contrast, for the older and higher terraces are composed of coarse black pitchstone sand which has a glaucous veil of *Artemisia* and *Atriplex canescens*. The newer silt along the present river, on the other hand, is covered with rich green meadows and in some places with bog plants.

The Ascent to Crater Lake, Oregon.

Although Medford, Oregon, is the centre of one of the richest fruit-growing districts in the United States, its annual rainfall is but 20 inches, for it is situated in the great longitudinal valley of Oregon, in the lee of the coast ranges. The conditions then, where no irrigation is practised, are those of a steppe. The journey from Medford at 1400 feet to the rim of Crater lake at 8000 feet represents perhaps the most striking change in vegetation which was seen on the Transcontinental Excursion. This stretch of 50 miles (over 80 by road) with its 6600-foot climb corresponds to an increase in annual rainfall probably of 50 inches.

For nearly 20 miles north from Medford there was little rise in altitude on the aggraded plain, and but slight change in the steppe-like vegetation. Then as the valley of the Rogue river narrowed, we entered a xerophilous woodland of dark-leafed Pacific oak (*Quercus Garryana*), arbutus, and small yellow pines, with an open undergrowth of manzanita (*Arctostaphylos*), the dark and spiny *Dahlia spinosa*, and other shrubs. The first change which appeared as we climbed was that the broad-leafed trees became restricted to the valley bottom, the yellow pines grew bigger, and the stately Douglas fir was seen at about 2000 feet, and with it the incense cedar (*Thuya occidentalis*). At about 3000 feet the sugar pine (*P. Lambertiana*) appeared. This noble tree is in many ways the most beautiful of the Cascade species, its great height and its smooth light red bark making it stand out boldly among the other trees.

The fine development of the sugar pine at this point is remarkable, for it is here about its northern limit. It appeared first with Douglas and cedar, and higher up we rode for miles through woods in which there was little else than this pine (Fig. 7), with an undergrowth of mountain laurel and beech. From this grand forest we emerged into an area recently

burned—a scene of utter desolation, the charred trunks, or sometimes merely the stumps remaining, to remind us that a great forest had stood there. As the slopes became steeper, at about 3500 feet, we passed through dense woods of lodgepole pine (*P. Murrayana*), which may have spread, after a fire, to take the place of a larger species. Above this, at about 6000 feet, at the foot of the steep ascent to the crater, came a zone of varied woodland, in which the trees were no longer giants, but were well grown: hemlock (*Tsuga Pattoniana*) and noble fir (*Abies nobilis*) predominated. Finally the five-leaved *Abies albicaulis* appeared. This tree extended above all other species, first as an open wood, and then in clumps of trees ever more and more stunted, upon the slopes of rich alpine pasture which reach almost to the summit.

The view from the edge of the crater can never be forgotten. Inwards lay the placid waters of the crater lake of the deepest blue tint, contrasting with the brilliant hues of the circling ring of precipice. Outwards there stretched on all sides a sea of peaks, almost smothered in those dense forests, which are the surest witness to the humid character of the winds of the Northern Pacific coast of the United States.

Northern Arizona, from the New Mexico Border to the Bottom of Grand Canyon.

Northern Arizona forms the southern part of the Colorado plateau, with its deep and narrow canyons and table-topped hills, or mesas. The plateau is, however, varied by volcanic masses which form outstanding features, such as the San Francisco mountains.

A night journey brought us from the Rio Grande basin in New Mexico to the Little Colorado in Arizona. We had left the outwash slopes of the southern Rockies with their isolated clumps of piñon pine and juniper, where the rainfall is some 20 inches, and we found ourselves in a much more arid region where the rainfall is under 10 inches (Holbrook, 7·9 inches).* Not a tree was to be seen; everywhere an unclosed growth of sage-brush, and a waggon ride to the south from Adamanna to visit the petrified forest showed only a change for the worse, to bare clay hills, except at the crossing of a dry wadi where aspens and golden *Bigelovia* bushes refreshed the eye.

Another excursion to Meteor crater showed similar vegetation, and there was but little to be seen even in the bottom of Cañon Diablo. The day's route afforded several evidences of the erosive action of sand-laden wind, and we were also lucky enough to see the manner in which the region receives much of its scanty rain—from small cyclonic storms sweeping across the land and causing precipitation over a narrow strip. On the following night the train made its way round the San Francisco mountains, and by daylight had reached the Grand Canyon. We were thus unable

* Bulletin Q, U.S. Weather Bureau, 'Climatology of the United States'

at this stage to see the gradual improvement in the vegetation. The Colorado plateau, in fact, rises steadily northward from the east of the mountains up to and beyond the Grand Canyon; at Cañon Diablo the altitude is 5000 feet, and on the south side of the Grand Canyon 7000 feet; there is a corresponding increase in the rainfall. Upon this tilted plateau the San Francisco mountains rise nearly to 13,000 feet. We had, however, to pass under the heavy forests of their slopes without seeing them, for the journey was by night.

The rainfall of the plateau south of Grand Canyon is sufficient to maintain an open woodland with a xerophilous undergrowth. A wide view (Fig. 8) over this tableland was afforded by a wooden watch-tower, erected by the Forest Service for use in locating fires.* Trees cover the southern plateau as far as the eye can reach, while a field-glass showed forests at the northern rim, 10 miles away.†

It is to be expected that this woodland of the south side will be at its best on the canyon edge, for not only does the plateau slope away from this, so that, as the highest part of the area, the rim receives the greatest precipitation, but there is also a special addition to the moisture here, for the air rising from the canyon below and cooling as it rises, seems to have moisture to spare at the top.

The woodland along this strip is formed of a variety of species, yellow pine (*Pinus ponderosa*) up to 50 feet in height, the small piñon pine (*Pinus edulis*), and the juniper (*Juniperus californica*). Mingled with the pines were a robinia (*Robinia neo-mexicana*), and the *Cowania Mexicana*, with small, dark, and sticky leaves and a white flower. Thus, while the existence of this open woodland point to relatively humid conditions, yet the species represented show that the precipitation really cannot be very great. That this is so is clear when the undergrowth is examined. It consists of a scrub-oak (*Quercus submollis*), sage brush, yucca (*Y. baccata*), and prickly pear (*Opuntia ficus indica*).

The Grand Canyon at this part is some 4500 feet deep (roughly 7000 to 2500 feet). The descent is broken at 3600–3800 feet, by a wide ledge —the Tonto plateau. Above this the Canyon is wide and cut in limestones and sandstones; below, it is a narrow gorge in granite.

For several hundred feet below the rim the steep slopes bear woods of Douglas fir (*Pseudotsuga Douglasii*)—a sure proof that the air must be relatively humid. Lower the Douglas gave place to juniper and piñon, and then to mixed scrub, growing on every ledge and crevice; oak and an

* As a result of the admirable organization of the U.S. Forest Service, the damage to forests from fires decreases steadily. In all forests where fires may be expected observation stations are maintained, equipped with instruments to enable the watchers to locate fires as soon as they break out, and to communicate—generally by telephone—with the nearest forest station. In this manner many fires are isolated at their start.

† The plateau here attains its greatest height, and the greater rainfall gives a rich forest of yellow pine.

Ephedra were perhaps the most noticeable. Then the feathery mesquit (*Prosopis*) came in and continued right to the bottom. Towards the Tonto platform the scrub became more dwarfed, but a pleasing and surprising variant occurred at the so-called "Indian Garden," where a spring comes out, and a verdant and tangled thicket of willow, poplar, and reeds meets the eye. Among the trees and pools, grape vines, *Baccharis*, and a *Datura* with large violet flowers were recognized. From this oasis the change is sudden to the semi-desert of the platform. The general tint of the vegetation was more grey than green, chiefly owing to the predominance of a low rosaceous shrub (*Colcogyne ramosissima*), which was grey at this season (September), though it is dark green after rains. Mingled with this shrub were the low *Atriplex canescens*, the globular *Echinocactus*, an agave, and the prickly pear.

The last 1000 feet of the descent were marked by more scattered shrubs of the same character, the mesquit giving a refreshing tint to the slopes; but very arid conditions appear to prevail at the bottom of the narrow canyon, and the dry winds which form the great heaps of blown sand bordering the Colorado river must greatly hinder the growth of plants.

Thus the journey through northern Arizona, from the eastern border to the bottom of the Grand Canyon, was marked first, by a gradual transition from semi-desert to fairly luxuriant woodland, and then by a sudden change back to a xerophilous vegetation.

It will be seen from the foregoing notes that the participants in this excursion of 1912 had opportunity to study in a general way a variety of aspects of the vegetation. The following are a few of the points which perhaps impressed themselves with greatest emphasis upon the observer. First, the dependence of the vegetation upon the climate, and especially upon conditions of temperature and moisture. Secondly, the great contrast of floristic types in extreme regions, *e.g.* the deciduous forest of the north-east and the cactus semi-desert of the south-west. Thirdly, the effects of the Ice Age on the vegetation. Fourthly, the effect of various forces destructive of vegetation. Under this last heading would come fire in the forests, river-erosion in the lower Mississippi, alkali on the flats of the Great Basin, hot waters and the salts contained in them in the geyser basins of the Yellowstone.

Moreover, to some members of the party this excursion provided the first opportunity of observing personally that essential similarity of vegetation types in corresponding parts of another continent. It is such observations which make us realize the full importance of the major natural regions of the globe and their classification.

The PRESIDENT (before the papers): Last autumn the American Geographical Society of New York celebrated the jubilee of its foundation. Many of its members are liberal minded and, I am happy to add, wealthy men, and the Society was able to carry out this celebration on a scale with which we in this country can hardly

attempt to compete. Among other things they arranged for an excursion across the United States from New York to San Francisco under the leadership of Prof. W. M. Davis of Harvard—a name very familiar to many in this room—with a view to enable geographers from other parts of the world to study some of the most salient features of American geomorphology. They invited the Geographical Societies of Europe to send delegates, for whose expenses they were kind enough to make themselves responsible from New York to San Francisco and back. A good many European geographers took advantage of this handsome offer, and our Society sent three delegates, Mr. Chisholm, lecturer in Geography at the University of Edinburgh and a geographer of long standing; Mr. Beckit, of the School of Geography at Oxford, one of Prof. Herbertson's efficient assistants; and Mr. Alan G. Ogilvie, also of the School of Geography at Oxford, and one of the most promising of our younger geographers. Mr. Chisholm had been in America before, and was able to compare certain conditions then and now, and he proposes to deal with the economic aspects of the excursion. Mr. Beckit and Mr. Ogilvie, as geographers of the younger school, had an excellent opportunity on such an excursion to become practically familiar with some of the great features with which, as geographers, they have to deal. Mr. Beckit will treat of the national parks of America, while Mr. Ogilvie will give us his impressions of the vegetation. As our three delegates brought home an ample store of photographs, their communications to-night will afford a fairly realistic idea of the geography of a portion, at any rate, of the United States of America.

The PRESIDENT (after the papers): We are honoured to-night by the presence of H.E. the American Ambassador, Dr. Page. I hope I may be allowed, on behalf of the Society, to extend to him the heartiest welcome, and if he is disposed to favour us with a few words we shall be most grateful.

H.E. The AMERICAN AMBASSADOR: I am exceedingly glad to have an opportunity to tell you that I have definite information of the very great pleasure that this excursion of distinguished European geographers gave my countrymen who travelled across the continent with them, and the citizens of the United States who met them going and coming. Their visit gave them great satisfaction, and it is yet very pleasantly remembered.

I am glad that in a Geographical Society it is not considered wholly inappropriate to talk of the economic aspects of the country. This journey was largely, very properly for geographical reasons, through the picturesque and barren lands of the country. A very small part of it touched the great rich economic regions. If you had gone somewhat further south on your westward journey you would have gone through the endless maize-fields and scarcely got out of sight of the growing maize. I saw them last October when they were in their highest beauty. If you had gone still further south you would have touched, not merely the outskirts of the great cotton belt, but you would have gone midway across it and, a little later, you would have seen the endless fields of white. Those are, of course, among the great economic factors of our continent, these great maize-fields and these great cotton-fields.

There are two regions in the United States which may perhaps interest you, though not perhaps from a geographical point of view. Prof. Shaler, who was a geologist of distinction in Harvard University, used to say that there were two places in the United States where man was sure to grow to a larger stature, and to be of larger value economically and spiritually, than anywhere else. One of those spots you visited in the north-west part of the state of Washington, being the extreme north-western state. There, said he, the rainfall is such, the altitude is such, and the beneficence of nature in general is such, and the soil is such, as

to give promise of this extraordinary development of mankind. Now, the rainfall happens to be, and the conditions of the soil also happen to be, very nearly what you have on this island. The second spot so favoured by Nature you did not see. It is a certain altitude on the eastern slope of the Appalachian mountains. There the rainfall and the soil conditions are favourable for man's best development. It so happens that these two regions are among the least populated in the United States. This outlook, therefore, is all for the future. Like a wise prophet, Prof. Shaler did not set any date. I think, however, his thesis can be maintained. A large immigration has set in to that north-western region. On the eastern slope of the Appalachians we yet have a sparse population, because it is one of the old slave states which is now just beginning to come to its own. If, therefore, any of you choose to go to the United States to make your own homes, and not merely to visit us and to come back, I commend to you this remark about these two regions made by one of our greatest scientific students.

Mr. W. Penn Cresson, a Secretary of the American Embassy: This unexpected honour at least gives me the opportunity of saying how much I have enjoyed the papers we heard read to-night, and the more so because I have lived some of the best years of my life in the western country they describe. I am still part owner of a ranch bordering on the Yellowstone Park near the North Fork of the Madison, where I hope some day to welcome the President and others of the Society. A great part of my life in the west was spent in the last remnant of what has been called the Great American Desert. That this term is a geographical fiction we all know; in fact, all that richly wooded country of which we have seen the photographs to-night was at one time so classed, together with the more arid regions of the alkali plains. However, I think it is a matter worthy of the attention of the Society, that where the Davis excursion travelled so easily by train and automobile, but a few years ago was an uninhabited country known by this title, *i.e.* the Great American Desert.

I also want to say something in connection with the remarks made on Yellowstone Park and that wonderful photograph showing the fallen growth beneath the forest trees. The appalling conditions which confront the American forester must be seen to be appreciated. Some of the best work done in fighting forest fires in the United States has been frequently done by the State militia under conditions as terrible as any in warfare. As a forest-land owner myself I hope some day to see the help of volunteer foresters enlisted in this work. Perhaps the Boy Scout movement might turn its attention to this field, and give trained help to the forest rangers, while enjoying a healthy holiday.

The President: We ought to be very grateful to our American guests for their kindness in addressing us as they have done this evening. You will wish me also to express our thanks to the readers of the papers, which have been genuine contributions to our scientific knowledge of the United States of America.

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THE SOUNDINGS OF THE ANTARCTIC SHIP "AURORA" BETWEEN TASMANIA AND THE ANTARCTIC CONTINENT (1912).*

By Captain J. K. DAVIS.

Dr. Mawson, in placing his plans before the Royal Geographical Society, indicated that an important part of his programme would be the oceanographical work upon which he proposed to employ the Expedition's vessel during the winter months subsequent to the landing of the various parties on the Antarctic coastline. A certain amount of this work having been carried out, I am placing a brief report before Sir John Murray, who has kindly consented to discuss the work and to indicate the most important direction in which it should be extended.

The *Aurora* left Hobart on December 2, 1911, for the Antarctic *viâ* Macquarie island. It was not possible to do any deep-sea work until after the main party and their equipment had been landed, owing to the lumbered-up state of the vessel's decks. From January 19, after our departure from the main base, a considerable number of soundings were taken along the edge of the continental shelf.

Winter Cruise of "Aurora," May 18 to July 10, 1912.—We left Sydney on May 18 and proceeded through Bass strait as far as the 140th meridian, when the course was altered to pass over the charted position of the Royal Company islands, of which nothing could be seen. Macquarie island was reached on June 7. We remained there until June 22, and then sailed for the Auckland islands, where we spent some days at Carnley harbour and at Port Ross. We left the last-named anchorage on July 6 and reached Port Lyttleton on July 11. During this cruise the weather was so bad that only eight deep-sea soundings were taken. Mr. E. Waite accompanied us as biologist.

Our No. 1 sounding-machine (Lucas) is fixed on the port side of the forecastle head. The wire is wound in by means of a belt worked by a small horizontal engine close by and directly in line with the machine; this engine, constructed for the *Scotia* (Scottish National Antarctic Expedition, 1902), was very kindly lent to us by Dr. W. S. Bruce. It proved to be just the right thing. On one occasion, in fine weather, the time occupied in taking a sounding of 2600 fathoms was just over an hour—reckoned from the time the vessel stopped until she was under weigh again.

Spring Cruise, November 12 to December 14, 1912.—The *Aurora* left Hobart on November 12, 1912, for a month's cruise in the deeper waters between Tasmania and the Auckland islands. My instructions were to visit Macquarie island in the first instance, sounding and dredging as opportunity offered; and to arrange for an extension of the cruise within

* Map, p. 420.

such limits as would permit of being back at Hobart not later than December 15. Prof. Flynn, of Hobart, accompanied us as biologist; and as several improvements had been made in our deep-sea gear, we anticipated good results in the limited time at our disposal. During this voyage an important rise was discovered 200 miles south of Tasmania, and a considerable number of soundings taken in its vicinity.

The *Aurora* left Hobart on the second Antarctic voyage on December 26, 1912. During our passage to Commonwealth bay we were able to obtain a good many soundings, but our subsequent detention there made it impossible to obtain more soundings along the Antarctic coastline. This, I hope, we shall be able to do during our next voyage.

NOTES ON THE ANTARCTIC SOUNDINGS OF THE "AURORA."

By Sir JOHN MURRAY, K.C.B., F.R.S.

THE series of soundings taken by Captain Davis on board the *Aurora*, as laid down on the accompanying map, are of very great interest and importance, defining as they do the sub-oceanic relations between Australia and the Antarctic continent. Previous to the year 1874, it was considered extremely doubtful whether there were any large extent of continental land around the South Pole, the prevalent opinion being that the land lying within the Antarctic Circle took the form of groups of volcanic islands, and this idea was favoured by Ross's discovery of active volcanoes (Mounts Erebus and Terror) in the far south. But when the *Challenger*, in February, 1874, dredged up from depths of 1950, 1675, and 1300 fathoms, at different points near the Antarctic Circle, fragments of true continental rocks, such as gneisses, granites, mica-schists, quartziferous diorites, grained quartzites, sandstones, limestones, and partially decomposed earthy shales, there was no longer room for doubt that an extensive continent really existed in the Antarctic, to which the name of Antarctica was given. It is true that the observations of Ross, D'Urville, and Wilkes showed the presence of such rocks in the Antarctic. Indeed, both Ross and Wilkes sounded on what may be regarded as the continental shelf and continental slope off South Victoria Land and Wilkes Land, and the *Challenger* soundings and dredgings showed that this continental material was more abundant in the shallower water far south than in the deeper water to the north. The deposits near the Ice Barrier were blue muds, and resembled the deposits forming in similar depths around other continental masses. To the north of the blue mud, the deposits were made up largely of the remains of diatoms abounding in the surface waters, and therefore called Diatom oozes, containing less continental *débris* than the blue muds. On proceeding northwards, the deposits graded into Globigerina oozes, in which continental detritus was rare or absent.

Since that time the continental shelf of Antarctica has been determined at several places by soundings, which indicate that the slopes are quite similar to those off other continental masses, except that the continental edge may perhaps lie deeper and farther seaward owing to the scouring action of the ice pushed off from the land.

At the present day, we have some knowledge of the Antarctic continental shelf in the following regions: (1) in the vicinity of South Victoria Land and along Wilkes Land westwards to the position of Termination Land; (2) in the Weddell sea, off Coats Land and Prince Regent Luitpold Land; and (3) in the Bellingshausen sea in the neighbourhood of Graham Land and westwards therefrom as far as long. 100° W. The extensive intervals between the regions above indicated are blank so far as shallow soundings are concerned, and the most important piece of scientific work that remains to be carried out in the Antarctic is to fill up these blanks, so that the outline of the Antarctic continent may be more and more accurately defined. The Ross sea, lying to the east of South Victoria Land, seems to be relatively shallow, the soundings recorded being all less than 500 fathoms. Off Adélie Land, in the vicinity of Mawson's main base, and westward as far as Mawson's west base, Captain Davis took some shallow soundings, to be referred to later. In the latter locality, Drygalski, on board the *Gauss*, took several shallow soundings, while Bruce and Filchner recorded depths less than 500 fathoms off Coats Land and Prince Regent Luitpold Land respectively. The shallow waters around Graham Land and the adjoining islands have been frequently explored within recent years, and Gerlache, in 1898, recorded some shallow soundings to the south of Peter I. island.

In 1886, the area of Antarctica was estimated, from all the information available at that time, to cover an area of about 3½ millions of square miles, but all subsequent soundings on the continental shelf seem to show that it is even more extensive, and at the present day the area is estimated to exceed 5 millions of square miles.

Captain Davis's series of soundings, shown on the accompanying map, were taken in 1912 and 1913. On January 19, 1912, Captain Davis left the main base, and took some valuable soundings along the edge of the pack ice. Off the main base a depth of 40 fathoms was found, and 120 fathoms just within the Antarctic circle, with 308 fathoms to the west and 398 fathoms to the east. Outside the Antarctic circle depths of 230, 180, and 210 fathoms were taken, and then the water was found to deepen abruptly to 1480 fathoms, indicating a steep slope in this position. To the westward of the main base, pack ice was encountered well to the north of the Antarctic Circle, and therefore (with the exception of the four soundings in the vicinity of the main base just mentioned) the soundings are outside the Antarctic Circle, that is to say, between lat. 64° and 66° S. The depth of water varied from 160 fathoms in lat. 65° S., long. 133° E. to 1500 fathoms in lat. 64½° S., long. 107° E., and in the neighbourhood of

the *Challenger* sounding in 1300 fathoms, off Queen Mary Land, Captain Davis took soundings in 110 and 120 fathoms.

During the winter cruise from May to July, 1912, two deep soundings were taken about the meridian of 140° E., in 2590 and 2452 fathoms, on the way to the position, in lat. 52½° S. long., 143° E., assigned to the Royal Company islands, of which no sign was seen, and also five shallow soundings between Auckland island and New Zealand in depths of 300 to 400 fathoms.

During the spring cruise, November—December, 1912, some excellent sounding work was done to the south of Tasmania. The water deepened to 2083 fathoms in lat. 45½° S., long. 147½° E., this sounding apparently indicating that the deep water (over 2000 fathoms) to the south and east of Australia is really continuous to the south of Tasmania. On proceeding southwards the soundings shallowed, and a submarine cone or ridge covered by 543 fathoms of water was discovered in lat. 47° S., long. 147½° E., apparently surrounded by deep water exceeding 2000 fathoms in depth. On approaching this rise the water shoaled from 1940 fathoms to 794 fathoms in a distance of 50 miles, giving a slope of about 1 in 40. Proceeding towards Macquarie island from this rise, several soundings in depths exceeding 2400 fathoms were taken, but to the north of Macquarie island, in lat. 53½° S., long. 159° E., soundings in 636 and 570 fathoms were taken, with deeper water (1750 fathoms) nearer the island—in fact, only 30 miles to the north of it. After taking some shallow soundings in 11 to 398 fathoms, a depth of 1548 fathoms was found only 3 miles, and a depth of 2745 fathoms 10½ miles, to the east of the island. Proceeding from Macquarie island to Auckland island, soundings in 1855, 2100, and 2430 fathoms were taken, showing that very deep water separates these islands. To the north-east of Auckland island, soundings in 1965, 2610, and 2700 fathoms were taken, whence the water shoaled on approaching the submarine rise to the south of Tasmania, on which additional soundings were taken.

On the second Antarctic cruise, starting from Hobart on December 26, 1912, some deep soundings were recorded to the south of lat. 50° S., which, taken in conjunction with three deep soundings previously made by Captain Scott, show that there is very deep water (between 2000 and 2600 fathoms) comparatively close to the Antarctic shores southward from Australia. It is sincerely hoped that Captain Davis may be able to continue and extend his sounding work in the forthcoming cruise for the relief of Dr. Mawson.

It is difficult, from the abbreviations made use of in the accompanying map, to draw any definite conclusions as to the nature of the deposits obtained by Captain Davis, but he informs me that he has secured an excellent series of bottom-samples from the soundings dealt with in this communication, and I have undertaken to examine and report upon these samples, correlating the results with what we already know of the ocean-floor in these southern regions.

THE VOYAGES OF CAPTAIN WILLIAM SMITH AND OTHERS TO THE SOUTH SHETLANDS.

By IDA LEE (Mrs. CHARLES BRUCE MARRIOTT).

THE charts and drawings of the first Antarctic explorers are so few in number that rarely have any been overlooked or forgotten, yet the picture given below of the little brig *Williams* nearing the South Shetlands, in February, 1819, has never, so far as we know, been published. In this voyage, Captain William Smith discovered the northernmost land of the

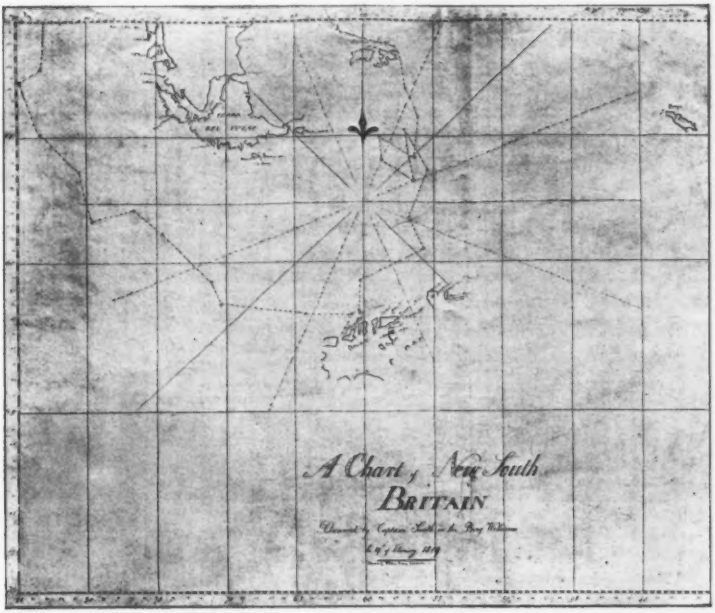

CHART OF SOUTH SHETLANDS, DRAWN BY WILLIAM HENRY GODDARD.
(*From the original in the Admiralty Library.*)

group which he then named New South Britain. During a subsequent voyage in the following October he entered a bay called by him George's bay, and having found a landing-place took possession of the country for King George III. In this way it came to pass, that for the first time in history man trod the shores of these far southern lands.

The chart, to which the drawing of the *Williams* is attached, will show that Captain Smith also gave names, such as New Plymouth, Deception and Desolation islands, Start point, Shirreff's cove, Cape Williams and Cape Smith, to localities to which they seemed appropriate.

Both chart and drawing were the work of William Henry Goddard, probably an officer on board the *Williams*.

Besides Goddard's chart, another was made in January, 1820, by Mr. Henry Foster, a midshipman in H.M.S. *Creole*, then off Buenos Aires. During the short interval which elapsed between the making of these two charts, the name of New South Britain was changed by Captain Smith to New South Shetland. Therefore, while on Goddard's chart the group is called by its original name, on Foster's, a copy of which was published with J. Miers' description of the discovery in the *Edinburgh Philosophical Journal*, 1820, it is inscribed as New South Shetland.

Foster's little chart will always possess a peculiar interest for those who follow the lives of our great seamen. He became a distinguished officer and a light in the scientific world, who, for a series of valuable experiments carried out while acting as astronomer to Sir W. E. Parry at Port Bowen and other places within the Arctic Circle, was awarded the Copley Medal in 1827. In 1831, while in command of the expedition that sailed in H.M.S. *Chanticleer*, he lost his life in the Chagres river, Gulf of Mexico.

Captain Smith returned to Valparaiso in November, and no one realized the importance of his discoveries more than Captain W. H. Shirreff of H.M.S. *Andromache*, then in port. He immediately ordered Mr. Edward Bransfield, the master, with several of the officers of the *Andromache*, to accompany Captain Smith to the South Shetlands, and to carry out an extensive survey of those islands.

THE "WILLIAMS" OFF THE SOUTH SHETLANDS, FROM GODDARD'S CHART.

The agreement, dated December 16, 1819, entered into between Captain Shirreff and Captain Smith, is still in existence, and in the light of subsequent voyages it is an interesting and important document. Not only because Captain Smith was, to quote Dr. O. Nordenskjöld, "the first who in a most indisputable manner made acquaintance with a part of the Antarctic continent," * but also because the expedition itself seems to have been the first fitted out *solely* for Antarctic discovery by any nation. By the terms of the agreement, Captain Smith bound himself to receive on board "the good brig called the *Williams of Blythe* of the burthen of 216 tons register now riding in the port of Valparaiso . . . all such officers and men as shall be ordered to proceed to such parts and on such service as shall be directed . . . and the said William Smith doth covenant the

* "Antarctica," p. 70.

said brig to be strong, firm, tight, staunch and substantial above water and beneath . . ." and besides various masts, sets of sails, gratings, boats, tackle, etc., necessary for such a voyage, "to have three large cables and one stream cable, four carriage guns not less than four-pounders, twenty-five muskets, the same number of cutlasses and three pairs of pistols, and to be manned with twenty-five officers and men."

The instructions issued to Bransfield are dated December 19, 1819, and the orders drawn up for his guidance on this pioneer voyage compare curiously with the directions supplied to commanders of succeeding expeditions. The following are extracts :—

"You are to proceed to about the latitude of 62° south and longitude 62° west to discover and ascertain the extent of that tract of land there seen by Mr. Smith in October last and whether it be merely an island or part of a continent; if the latter you will explore the land to the eastward and determine if it be connected with Southern Thule and Sandwich Land. If you should find great difficulty in performing this you will explore the coast to the southward and westward.

"You will explore every harbour you may discover, making charts and noting the soundings and whether secure for ships to ride in. . . . You will ascertain the truth as to the abundance of sperm whale, otters and seals upon the coasts.

"You will ascertain the natural resources for supporting a colony and maintaining a population, or if it be already inhabited, will minutely observe the character, habits, dresses and customs of the inhabitants, to whom you will display every friendly disposition.

"You will note minutely the appearance of the land, the face of the country, description and depth of soil, collecting specimens of each particular kind of rock and noting the inclination and dip of the strata. . . . You will ascertain the height of the mountains and the existence of rivers, streams or lakes of fresh and salt water. . . .

"You will collect specimens of each plant . . . taking care that Mr. Bone makes drawings of each as well as of every animal, bird, fish, insect and reptile. . . . You will keep a meteorological journal noting the variation of the barometer, thermometer and weather every two hours and the variation of the magnetic needle . . . and ascertain correctly the latitudes and longitudes of the headlands; the gentlemen under you will also keep a separate journal which they are on no account to compare but to deliver to me on their return sealed up.

"In case of your meeting with any foreign vessel . . . you will inform the captains or masters that the country has already been taken possession of, but more strongly to insure the right of Great Britain you will yourself on each separate quarter of the land take possession of it in the name and behalf of His Majesty King George III., his heirs and successors, planting a board with the Union Jack painted on and words written under to that effect. Should your time exceed six months, instead of returning to this port . . . you will make the best of your way to England . . . and immediately give notice to the Lords Commissioners of the Admiralty of your proceedings.

"Although I have thought necessary to point out . . . many things of great utility to natural history, you will remember the great and leading object you are to attend to is . . . the survey of the coast and harbours.

"Given under my hand on board H.M.S. *Andromache*, Valparaiso, this 19th day of December, 1819.

"W. H. Shirreff."

The *Williams* reached the South Shetlands on January 16, 1820, and anchored again in George's bay near Penguin island. Much of the coast was examined, but from the lateness of the season and the constant fogs Bransfield was unable to ascertain whether the land was really a continent or consisted merely of chains or groups of islands. The expedition obtained much useful information both on land and sea, and on one occasion explored as far south as 65°. Bransfield returned to Valparaiso on April 14.

Through the years 1820–1821 and 1822, New South Shetland became the headquarters of a great number of whaling vessels from England and from America, and of one, the *Lynx*, from Sydney, New South Wales. Captain Walker, of the whaler *John of London*, reported, on his return to England in 1821, that in that year no fewer than thirty American ships had been sealing there, and had named the port which they especially fancied Yankee Harbour.

The early history of New South Shetland is best told by Captain Robert Fildes, commander of a whaling fleet from Liverpool, whose journal gives very vivid accounts of what happened there. A seaman of great experience, he well describes the dangers of the coast and the violent gales with which ships had to contend. One point after another, cape and island, bay and strait, claimed its toll of human life, and soon various parts of the country became best known through the fact that they had been connected with disaster. On one beach, called Half Moon beach, in Blyth bay, Captain Smith, who had again returned to trade there, found an anchor-stock, iron-hooped and copper-bolted, as well as sails, booms and other spars, grim evidence of the fate that had overtaken a Spanish seventy-four which had left Spain for Lima with 1400 men in order to fight the Patriots, and had never since been heard of. "This anchor-stock Smith took to England with him," says Fildes, "to have a coffin made of it, and it has been identified."

Gales from the eastward blew with hurricane force and were accompanied generally by heavy falls of snow, nearly all the mishaps that took place being due to them. "No less than seven vessels have been lost," wrote Fildes, "and all in easterly gales, excepting the *Clothier*, which struck on a sunken rock." On Christmas Day, 1820, the *Lady Troubridge* of Liverpool was driven ashore in Blyth bay, and on the south beaches of the north side of King George's island the wreckage of two vessels came ashore, consisting of portions of their keels, fore-timbers and a mast-stay, one apparently being a ship of 200 tons, the other of about 80 tons. Blyth bay appears to have maintained an evil reputation from the first. There the brig *Cora* of Liverpool was wrecked while the *Williams* and the *Indian* narrowly escaped, both being blown out of the bay at the same time. Fildes gives an amusing description of how, after the *Cora* was lost, a tent was constructed of sails and puncheons with the heads taken out, which were used by the sailors as sleeping bunks. One of these being to spare,

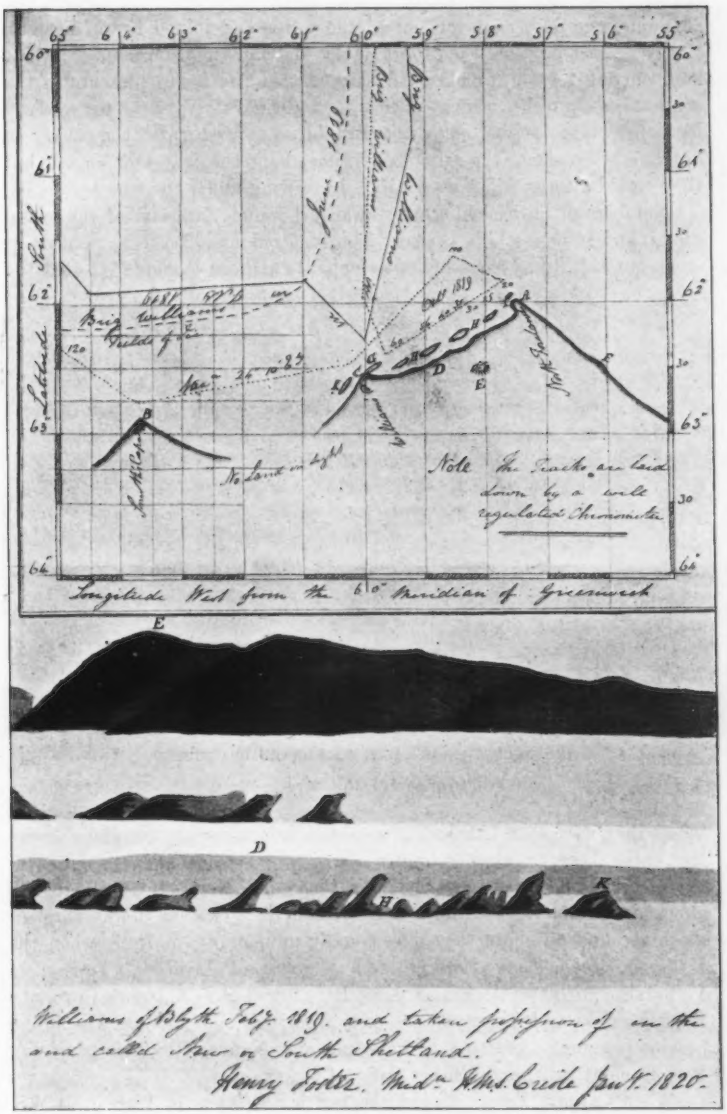
Longitude West from the 60° Meridian of Greenwich
Note The Tracks are laid down by a well regulated Chronometer
Williams & Blyth. Feby. 1819. and taken possession of on the
and called New or South Shetland.
Henry Foster. Mid.n R.N.S. Guide put.t 1820.

CHART AND DRAWINGS BY HENRY FOSTER.
(From the original in the Admiralty Library.)

the ship's cat took possession of it, and, to the surprise of the sailors, two penguins, one day, came up out of the water and joined her in her cot, "they neither minding the sailors in the tent nor the cat them." By her loud purring the shipwrecked cat showed that she found pleasure in the companionship of her strange friends, and although they went to sea daily for hours, upon landing again they would always return to the cask. In order to tease them, the sailors sometimes kept the tent-door closed, but they would always find a way into it by getting under the canvas.

Numbers of fin-backed whales swarmed round the coast of the island group, and from the hills as many as a hundred could be seen spouting at once, but thickly as the seals, sea-elephants and sea-leopards infested the

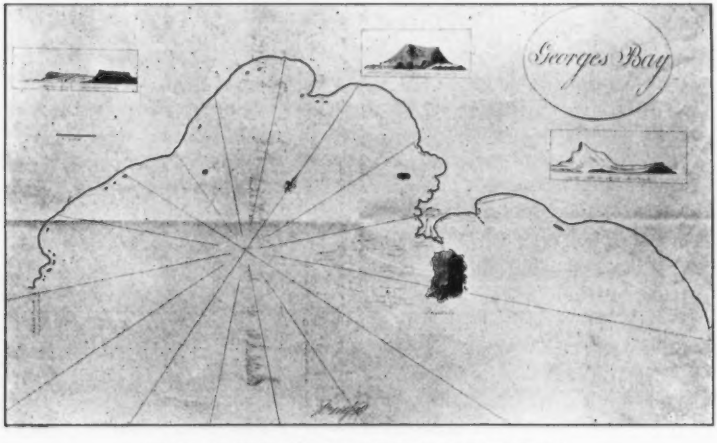

CHART OF GEORGE'S BAY, BY EDWARD BRANSFIELD.

(*From the original in the Admiralty Library.*)

shores they were soon killed off in incalculable numbers by the ships' crews that came there.

In Fildes' day, between Shirreff's Cove and New Plymouth, it was almost impossible to haul up a boat without first clearing a way through the seals, and on shore they were equally numerous; in 1821, when the *Williams*, *John*, *Lady Frances*, and *Mercury* of Liverpool, *Dragon* of Valparaiso, with two American ships, lay at anchor in Shirreff's Cove, the English crews took away 95,000 skins from this spot alone. The birds, besides penguins, consisted of Cape pigeons, Nellys (*Ossifraga gigantea*), Port Egmont hens, and Mother Cary's Chickens.

When Captain Foster visited the South Shetlands in 1829 in H.M.S. *Chanticleer*, few whaling ships frequented the group, the great slaughter having diminished both seals and whales in these waters.

THE FORTHCOMING NEW EDITION OF THE 1-INCH ORDNANCE SURVEY MAP.

The report of the Director-General of the Ordnance Survey for the year ending March 31, 1913, contains the following statement regarding the new edition of the 1-inch map, which has been in active contemplation since Colonel Close's appointment to command the Survey:—

"Experiments have been made during the year with a view to improving the character of the coloured edition of the 1-inch map. It has been found that, without adopting any heroic measures, there will be no difficulty in greatly improving the map in the new issue. It is not likely that any sheets of this issue will be published before 1914."

By the courtesy of the Director-General an advance copy of the Killarney District sheet has been sent to the Society, and may be seen in the Map-Room. This sheet is of remarkable beauty. It deserves the more careful examination inasmuch as we are assured above that no "heroic measures" have been necessary. We may understand by this that no new engraving has been done. All the new plates necessary have been inexpensively prepared on transfers from the original copper plates; and the success of the map is due to skilled use of all the recent improvements in colour printing and in transparent inks.

The existing coloured 1-inch map of Great Britain (3rd edition) shows the relief of the ground by spot heights; by contours, rather heavy, in red; and by hachures in sepia. In the new edition the spot heights of course remain unchanged; the contours are fine dotted lines in black; and the hachures are in warm pale brown. The depth of the hachures is, as before, sensibly independent of the direction of slope: they are nearly equivalent to "vertical" hill-shading, their nominal superiority being, in fact, pretty well discounted by the conventionalization that has overtaken them in the process of engraving.

Superposed on the contours and vertical hachures we have two features new to the inch map—an oblique hill shade in bluish-grey, and a pale set of layer tints. Between sea-level and the 300-feet contour the tint is pale yellowish-green. Above 300 it becomes slightly browner and warmer, with increased depth of colour at 600 and at 1250 feet. At least, this appears to be the system. But the changes of layer tint are so delicately graded, and so much overlaid by the hachures of the same tone of colour, that it is difficult to be quite certain that the above analysis is correct. That any uncertainty should be possible is the best testimony to the soft and perfectly blended effect of the whole map.

We believe that this is the most complex system of hill representation yet adopted. The French 1 : 50,000 map has contours, and the two-coloured vertical and oblique hill-shading, but no layer tints. The Bavarian staff map on the 1 : 250,000 scale has contours, oblique shading in grey, and

layer tints, but no vertical hill-shading. It has been left to the Ordnance Survey to employ every canonical method of hill representation in an admirable blend.

Some of the minor features of the map are of considerable interest and value. The classification of roads has been made more precise by colouring the main roads a deep reddish-brown, the second-class roads remaining the usual yellow. Some further sub-classification is promised in the forthcoming English sheets. Woods are shown by black tree signs on a pale green ground. Rivers are in a curious opaque Egyptian blue. Lakes and sea are tinted by fine horizontal lines, presumably of the same colour.

It may be thought, perhaps, that the only feature of the map which is not quite successful is this representation of water. In accordance with the old convention the lake margins north and west are shown by a heavy line, that is to say, by a river (on the system of colouring here adopted). The sea margins, on the other hand, are delicate continuous black lines. Thus the junction of river with lake or sea is not quite happy. But it is probable that any improvement would require the addition of one or more to the already large number of printings on the sheet.

An improvement of capital importance is promised for the new edition of the English map. *Contours at 50-feet vertical interval will be shown right up to the top of the mountains.* This, if not "heroic," is at any rate a bold solution of the problem which must have vexed every Director-General since the unhappy day when it was decided that at 1000 feet the vertical interval of the contours should suddenly jump from 100 to 250 feet. A generation or two of users of the 1-inch map have prayed for the day when they might see the 100-feet interval carried upward. The 50-feet interval right up is a splendid gift.

There can be no hesitation in pronouncing the Killarney District sheet to be a long way the best topographical sheet of gently mountainous country yet published. Geographers will be foremost in acknowledging the great service to the country done by the Director-General of the Ordnance Survey in producing this beautiful map.

THE REDISTRIBUTION OF MANKIND.*

By Professor H. N. DICKSON, M.A., D.Sc.

SINCE the last meeting of this Section the tragic fate of Captain Scott's party, after its successful journey to the South Pole, has become known; and our hopes of welcoming a great leader, after great achievement, have been disappointed. There is no need to repeat here the narrative of events, or to dwell upon the lessons afforded by the skill, and resource, and heroic persistence, which endured to the end. All these have been, or will be, placed upon permanent record. But it is right that we should add our word of appreciation, and proffer our

* Presidential address to the Geographical Section at the British Association for the Advancement of Science, Birmingham, September 11, 1913.

sympathy to those who have suffered loss. It is for us also to take note that this last of the great Antarctic expeditions has not merely reached the Pole, as another has done, but has added, to an extent that few successful exploratory undertakings have ever been able to do, to the sum of scientific geographical knowledge. As the materials secured are worked out it will, I believe, become more and more apparent that few of the physical and biological sciences have not received contributions, and important contributions, of new facts; and also that problems concerning the distribution of the different groups of phenomena and their action and reaction upon one another—the problems which are specially within the domain of the geographer—have not merely been extended in their scope but have been helped towards their solution.

The reaching of the two Poles of the Earth brings to a close a long and brilliant chapter in the story of geographical exploration. There is still before us a vista of arduous research in geography, bewildering almost in its extent, in such a degree indeed that "the scope of geography" is in itself a subject of perennial interest. But the days of great pioneer discoveries in topography are definitely drawn to their close. We know the size and shape of the earth, at least to a first approximation, and as the map fills up we know that there can be no new continents and no new oceans to discover, although all are still, in a sense, to conquer. Looking back, we find that the qualities of human enterprise and endurance have shown no change; we need no list of names to prove that they were alike in the days of the earliest explorations, of the discovery of the New World or of the sea route to India, of the "Principall Navigations," or of this final attainment of the Poles. The love of adventure and the gifts of courage and endurance have remained the same: the order of discovery has been determined rather by the play of imagination upon accumulated knowledge, suggesting new methods and developing appropriate inventions. Men have dared to do risky things with inadequate appliances, and in doing them have shown how the appliances may be improved and how new enterprises may become possible as well as old ones easier and safer. As we come to the end of these "great explorations," and are restricted more and more to investigations of a less striking sort, it is well to remember that in geography, as in all other sciences, research continues to make as great demands as ever upon those same qualities, and that the same recognition is due to those who continue in patient labour.

When we look into the future of geographical study, it appears that for some time to come we shall still be largely dependent upon work similar to that of the pioneer type to which I have referred, the work of perfecting the geographer's principal weapon, the map. There are many parts of the world about which we can say little except that we know they exist; even the topographical map, or the material for making it, is wanting; and of only a few regions are there really adequate distributional maps of any kind. These matters have been brought before this Section and discussed very fully in recent years, so I need say no more about them, except perhaps to express the hope and belief that the production of topographical maps of difficult regions may soon be greatly facilitated and accelerated with the help of the new art of flying.

I wish to-day rather to ask your attention for a short time to a phase of pioneer exploration which has excited an increasing amount of interest in recent years. Civilised man is, or ought to be, beginning to realise that in reducing more and more of the available surface of the earth to what he considers a habitable condition he is making so much progress, and making it so rapidly, that the problem of finding suitable accommodation for his increasing numbers must become urgent in a few generations. We are getting into the position of the

merchant whose trade is constantly expanding and who foresees that his premises will shortly be too small for him. In our case removal to more commodious premises elsewhere seems impossible—we are not likely to find a means of migrating to another planet—so we are driven to consider means of rebuilding on the old site, and so making the best of what we have, that our business may not suffer.

In the type of civilization with which we are most familiar there are two fundamental elements—supplies of food energy, and supplies of mechanical energy. Since at present, partly because of geographical conditions, these do not necessarily (or even in general) occur together, there is a third essential factor, the line of transport. It may be of interest to glance, in the cursory manner which is possible upon such occasions, at some geographical points concerning each of these factors, and to hazard some speculations as to the probable course of events in the future.

In his Presidential Address to the British Association at its meeting at Bristol in 1898, Sir William Crookes gave some valuable estimates of the world's supply of wheat, which, as he pointed out, is "the most sustaining food-grain of the great Caucasian race." Founding upon these estimates, he made a forecast of the relations between the probable rates of increase of supply and demand, and concluded that, "Should all the wheat-growing countries add to their (producing) area to the utmost capacity, on the most careful calculation the yield would give us only an addition of some 100,000,000 acres, supplying, at the average world-yield of 12·7 bushels to the acre, 1,270,000,000 bushels, just enough to supply the increase of population among bread-eaters till the year 1931." The President then added, "Thirty years is but a day in the life of a nation. Those present who may attend the meeting of the British Association thirty years hence will judge how far my forecasts are justified."

Half the allotted span has now elapsed, and it may be useful to inquire how things are going. Fortunately this can be easily done, up to a certain point at any rate, by reference to a paper published recently by Dr. J. F. Unstead,* in which comparisons are given for the decades 1881–90, 1891–1900, and 1901–10. Dr. Unstead shows that the total wheat harvest for the world may be estimated at 2,258 million bushels for the first of these periods, 2,575 million for the second, and 3,233 million for the third, increases of 14 per cent. and 25 per cent. respectively. He points out that the increases were due "mainly to an increased acreage," the areas being 192, 211, and 242 million acres, but also "to some extent (about 8 per cent.) to an increased average yield per acre, for while in the first two periods this was 12 bushels, in the third period it rose to 13 bushels per acre."

If we take the period 1891–1900, as nearly corresponding to Sir William Crookes' initial date, we find that the succeeding period shows an increase of 658 million bushels, or about half the estimated increase required by 1931, and that attained chiefly by "increased acreage."

But signs are not wanting that increase in this way will not go on indefinitely. We note (also from Dr. Unstead's paper) that in the two later periods the percentage of total wheat produced which was exported from the United States fell from 32 to 19, the yield per acre showing an increase meanwhile to 14 bushels. In the Russian Empire the percentage fell from 26 to 23, and only in the youngest of the new countries—Canada, Australia, the Argentine—do we find large proportional increases. Again, it is significant that in the United Kingdom, which is, and always has been, the most sensitive of all wheat-producing countries to

* *Geographical Journal*, August and September, 1913.

variations in the floating supply, the *rate* of falling-off of home production shows marked if irregular diminution.

Looking at it in another way, we find (still from Dr. Unstead's figures) that the total amount sent out by the great exporting countries averaged, in 1881–90 292 million bushels, 1891–1900 402 millions, 1901–10 532 millions. These quantities represent respectively 13·0, 15·6, and 16·1 per cent. of the total production, and it would appear that the percentage available for export from these regions is, for the time at least, approaching its limit, *i.e.* that only about one-sixth of the wheat produced is available from surpluses in the regions of production for making good deficiencies elsewhere.

There is, on the other hand, abundant evidence that improved agriculture is beginning to raise the yield per acre over a large part of the producing area. Between the periods 1881–90 and 1901–10 the average in the United States rose from 12 to 14 bushels; in Russia from 8 to 10; in Australia from 8 to 10. It is likely that, in these last two cases at least, a part of the increase is due merely to more active occupation of fresh lands as well as to use of more suitable varieties of seed, and the effect of improvements in methods of cultivation alone is more apparent in the older countries. During the same period the average yield increased in the United Kingdom from 28 to 32 bushels, in France from 17 to 20, Holland 27 to 33, Belgium 30 to 35, and it is most marked in the German Empire, for which the figures are 19 and 29.

In another important paper * Dr. Unstead has shown that the production of wheat in North America may still, in all likelihood, be very largely increased by merely increasing the area under cultivation, and the reasoning by which he justifies this conclusion certainly holds good over large districts elsewhere. It is of course impossible, in the present crude state of our knowledge of our own planet, to form any accurate estimate of the area which may, by the use of suitable seeds or otherwise, become available for extensive cultivation. But I think it is clear that the available proportion of the total supply from "extensive" sources has reached, or almost reached, its maximum, and that we must depend more and more upon intensive farming, with its greater demands for labour.

The average total area under wheat is estimated by Dr. Unstead as 192 million acres for 1881–90, 211 million acres for 1891–1900, and 242 million acres for 1901–10. Making the guess, for we can make nothing better, that this area may be increased to 300 million acres, and that under ordinary agriculture the average yield may eventually be increased to 20 bushels over the whole, we get an average harvest of 6000 million bushels of wheat. The average wheat-eater consumes, according to Sir William Crookes' figures, about four and a half bushels per annum; but the amount tends to increase. It is as much (according to Dr. Unstead) as six bushels in the United Kingdom and eight bushels in France. Let us take the British figure, and it appears that on a liberal estimate the earth may in the end be able to feed permanently 1000 million wheat-eaters. If prophecies based on population statistics are trustworthy the crisis will be upon us before the end of this century. After that we must either depend upon some substitute to reduce the consumption per head of the staple foodstuff, or we must take to intensive farming of the most strenuous sort, absorbing enormous quantities of labour and introducing, sooner or later, serious difficulties connected with plant-food. We leave the possibility of diminishing the rate of increase in the number of bread-eaters out of account.

We gather, then, that the estimates formed in 1898 are in the main correct,

* *Geographical Journal*, April and May, 1912.

and the wheat problem must become one of urgency at no distant date, although actual shortage of food is a long way off. What is of more immediate significance to the geographer is the element of change, of return to earlier conditions, which is emerging even at the present time. If we admit, as I think we must do, that the days of increase of extensive farming on new land are drawing to a close, then we admit that the assignment of special areas for the production of the food-supply of other distant areas is also coming to its end. The opening up of such areas, in which a sparse population produces food in quantities largely in excess of its own needs, has been the characteristic of our time, but it must give place to a more uniform distribution of things, tending always to the condition of a moderately dense population, more uniformly distributed over large areas, capable of providing the increased labour necessary for the higher type of cultivation, and self-supporting in respect of grain-food at least. We observe in passing that the colonial system of our time only became possible on the large scale with the invention of the steam locomotive, and that the introduction of railway systems in the appropriate regions, and the first tapping of nearly all such regions on the globe, has taken less than a century.

Concentration in special areas of settlement, formerly chiefly effected for military reasons, has in modern times been determined more and more by the distribution of supplies of energy. The position of the manufacturing district is primarily determined by the supply of coal. Other forms of energy are, no doubt, available, but, as Sir William Ramsay showed in his Presidential Address at the Portsmouth meeting in 1911, we must in all probability look to coal as being the chief permanent source.

In the early days of manufacturing industries the main difficulties arose from defective land transport. The first growth of the industrial system, therefore, took place where sea transport was relatively easy; raw material produced in a region near a coast was carried to a coalfield also near a coast, just as in the times when military power was chiefly a matter of "natural defences" the centre of power and the food-producing colony had to be mutually accessible. Hence the Atlantic took the place of the Mediterranean, Great Britain eventually succeeded Rome, and eastern North America became the counterpart of Northern Africa. It is to this, perhaps, more than to anything else, that we in Britain owe our tremendous start amongst the industrial nations, and we observe that we used it to provide less favoured nations with the means of improving their system of land transport, as well as actually to manufacture imported raw material and redistribute the products.

But there is, of course, this difference between the supply of foodstuff (or even military power) and mechanical energy, that in the case of coal at least it is necessary to live entirely upon capital; the storing up of energy in new coalfields goes on so slowly in comparison with our rate of expenditure that it may be altogether neglected. Now, in this country we began to use coal on a large scale a little more than a century ago. Our present yearly consumption is of the order of 300 millions of tons, and it is computed * that at the present rate of increase "the whole of our available supply will be exhausted in 170 years." With regard to the rest of the world we cannot, from lack of *data*, make even the broad assumptions that were possible in the case of wheat supply, and for that and other reasons it is therefore impossible even to guess at the time which must elapse before a universal dearth of coal becomes imminent; it is perhaps sufficient to observe that to the best of our knowledge and belief one of the world's largest groups of coalfields (our own) is not likely to last three centuries in all.

* "General Report of the Royal Commission on Coal Supplies," 1906.

Here again the present interest lies rather in the phases of change which are actually with us. During the first stages of the manufacturing period energy in any form was exceedingly difficult to transport, and this led to intense concentration. Coal was taken from the most accessible coalfield and used, as far as possible, on the spot. It was chiefly converted into mechanical energy by means of the steam-engine, an extremely wasteful apparatus in small units, and hence still further concentration; thus the steam-engine is responsible in part for the factory system in its worst aspect. The less accessible coalfields were neglected. Also, the only other really available source of energy—water-power—remained unused, because the difficulties in the way of utilizing movements of large quantities of water through small vertical distances (as in tidal movements) are enormous; the only easily applied source occurs where comparatively small quantities of water fall through considerable vertical distances, as in the case of waterfalls. But, arising from the geographical conditions, waterfalls (with rare exceptions such as Niagara) occur in the "torrential" part of the typical river-course, perhaps far from the sea, almost certainly in a region too broken in surface to allow of easy communication or even of industrial settlement of any kind.

However accessible a coalfield may be to begin with, it sooner or later becomes inaccessible in another way, as the coal near the surface is exhausted and the workings get deeper. No doubt the evil day is postponed for a time by improvements in methods of mining—a sort of intensive cultivation—but as we can put nothing back the end must be the same, and successful competition with more remote but more superficial deposits becomes impossible. And every improvement in land transport favours the geographically less accessible coalfield.

From this point of view it is impossible to overestimate the importance of what is to all intents and purposes a new departure of the same order of magnitude as the discovery of the art of smelting iron with coal, or the invention of the steam-engine, or of the steam locomotive. I mean the conversion of energy into electricity, and its transmission in that form (at small cost and with small loss) through great distances. First we have the immediately increased availability of the great sources of cheap power in waterfalls. The energy may be transmitted through comparatively small distances and converted into heat in the electric furnace, making it possible to smelt economically the most refractory ores, as those of aluminium, and converting such unlikely places as the coast of Norway or the West Highlands of Scotland into manufacturing districts. Or it may be transmitted through greater distances to regions producing quantities of raw materials, distributed there widespread to manufacturing centres, and reconverted into mechanical energy. The Plain of Lombardy produces raw materials in abundance, but Italy has no coal supply. The waterfalls of the Alps yield much energy, and this transmitted in the form of electricity (in some cases for great distances) is converting Northern Italy into one of the world's great industrial regions. Chisholm gives an estimate of a possible supply of power amounting to 3,000,000 horse-power, and says that of this about one-tenth was already being utilized in the year 1900.

But assuming again, with Sir William Ramsay, that coal must continue to be the chief source of energy, it is clear that the question of accessibility now wears an entirely different aspect. It is not altogether beyond reason to imagine that the necessity for mining, as such, might entirely disappear, the coal being burnt *in situ* and energy converted directly into electricity. In this way some coalfields might conceivably be exhausted to their last pound without serious increase in the cost of getting. But for the present it is enough to note that, however inaccessible any coalfield may be from supplies of raw material, it is

only necessary to establish generating stations at the pit's mouth and transport the energy to where it can be used. One may imagine, for example, vast manufactures carried on in what are now the immense agricultural regions of China, worked by power supplied from the great coal deposits of Shan-si.

There is, however, another peculiarity of electrical power which will exercise increasing influence upon the geographical distribution of industries. The small electric motor is a much more efficient apparatus than the small steam-engine. We are, accordingly, already becoming familiar with the great factory in which, instead of all tools being huddled together to save loss through shafting and belting, and all kept running all the time, whether busy or not (because the main engine must be run), each tool stands by itself and is worked by its own motor, and that only when it is wanted. Another of the causes of concentration of manufacturing industry is therefore reduced in importance. We may expect to see the effects of this becoming more and more marked as time goes on, and other forces working towards uniform distribution make themselves more felt.

The points to be emphasised so far, then, are, first, that the time when the available areas whence food supply as represented by wheat is derived are likely to be taxed to their full capacity within a period of about the same length as that during which the modern colonial system has been developing in the past; secondly, that cheap supplies of energy may continue for a longer time, although eventually they must greatly diminish; and, thirdly, there must begin in the near future a great equalization in the distribution of population. This equalization must arise from a number of causes. More intensive cultivation will increase the amount of labour required in agriculture, and there will be less difference in the cost of production and yield due to differences of soil and climate. Manufacturing industries will be more uniformly distributed, because energy, obtained from a larger number of sources in the less accessible places, will be distributed over an increased number of centres. The distinction between agricultural and industrial regions will tend to become less and less clearly marked, and will eventually almost disappear in many parts of the world.

The effect of this upon the third element is of first-rate importance. It is clear that as the process of equalization goes on the relative amount of long-distance transport will diminish, for each district will tend more and more to produce its own supply of staple food and carry on its own principal manufactures. This result will naturally be most marked in what we may call the "east-and-west" transport, for as climatic controls primarily follow the parallels of latitude, the great *quantitative* trade, the flow of foodstuffs and manufactured articles to and fro between peoples of like habits and modes of life, runs primarily east and west. Thus the transcontinental functions of the great North American and Eurasian railways, the east-and-west systems of the inland waterways of the two continents, and the connecting-links furnished by the great ocean ferries, must become of relatively less importance.

The various stages may be represented, perhaps, in some such manner as this. If **I** is the cost of producing a thing locally at a place A by intensive cultivation or what corresponds to it, if **E** is the cost of producing the same thing at a distant place B, and **T** the cost of transporting it to A, then at A we may at some point of time have a more or less close approximation to

$$\mathbf{I} = \mathbf{E} + \mathbf{T}.$$

We have seen that in this country, for example, **I** has been greater than **E**+**T** for wheat ever since, say, the introduction of railways in North America, that the excess tends steadily to diminish, and that however much it may be possible to

reduce **T** either by devising cheaper modes of transport or by shortening the distance through which wheat is transported, **E**+**T** must become greater than **I**, and it will pay us to grow all or most of our own wheat. Conversely, in the seventies of last century **I** was greater than **E**+**T** in North America and Germany for such things as steel rails and rolling-stock, which we in this country were cultivating "extensively" at the time on more accessible coalfields, with more skilled labour and better organization than could be found elsewhere. In many cases the positions are now, as we know, reversed, but geographically **I** must win all round in the long run.

In the case of transport between points in different latitudes the conditions are, of course, altogether dissimilar, for in this case commodities consist of foodstuffs, or raw materials, or manufactured articles, which may be termed luxuries, in the sense that their use is scarcely known until cheap transport makes them easily accessible, when they rapidly become "necessaries of life." Of these the most familiar examples are tea, coffee, cocoa, and bananas, indiarubber and manufactured cotton goods. There is here, of course, always the possibility that wheat as a staple might be replaced by a foodstuff produced in the tropics, and it would be extremely interesting to study the geographical consequences of such an event as one-half of the surface of the earth suddenly coming to help in feeding the two quarters on either side; but for many reasons, which I need not go into here, such a consummation is exceedingly unlikely. What seems more probable is that the trade between different latitudes will continue to be characterized specially by its variety, the variety doubtless increasing, and the quantity increasing in still larger measure. The chief modification in the future may perhaps be looked for in the occasional transference of manufactures of raw materials produced in the tropics to places within the tropics, especially when the manufactured article is itself largely consumed near regions of production. The necessary condition here is a region, such as (*e.g.*) the monsoon region, in which there is sufficient variation in the seasons to make the native population laborious; for then, and apparently only then, is it possible to secure sufficient industry and skill by training, and therefore to be able to yield to the ever-growing pressure in more temperate latitudes due to increased cost of labour. The best examples of this to-day are probably the familiar ones of cotton and jute manufacture in India. With certain limitations, manufacturing trade of this kind is, however, likely to continue between temperate and strictly tropical regions, where the climate is so uniform throughout the year that the native has no incentive to work. There the collection of the raw material is as much as, or even more than can be looked for—as in the case of mahogany or wild rubber. Where raw material has to be cultivated—as cotton, cultivated rubber, etc.—the raw material has to be produced in regions more of the monsoon type, but it will probably—perhaps as much for economic as geographical reasons—be manufactured at some centre in the temperate zones, and the finished product transported thence, when necessary, to the point of consumption in the tropics.

We are here, however, specially liable to grave disturbances of distribution arising from invention of new machinery or new chemical methods; one need only mention the production of sugar or indigo. Another aspect of this which is not without importance may perhaps be referred to here, although it means the transference of certain industries to more accessible regions merely, rather than a definite change of such an element as latitude. I have in mind the sudden conversion of an industry in which much labour is expended on a small amount of raw material into one where much raw material is consumed, and by the application of power-driven machinery the labour required is greatly

diminished. One remembers when a fifty-shilling Swiss watch, although then still by tradition regarded as sufficiently valuable to deserve enclosure in a case constructed of a precious metal, was considered a marvel of cheapness. American machine-made watches, produced by the ton, are now encased in the baser metals and sold at some five shillings each, and the watch-making industry has ceased to be specially suited to mountainous districts.

In considering the differences which seem likely to arise in what we may call the regional pressures of one kind and another, pressures which are relieved or adjusted by and along certain lines of transport, I have made a primary distinction between "east-and-west" and "north-and-south" types because both in matters of food-supply and in the modes of life which control the nature of the demand for manufactured articles climate is eventually the dominant factor; and, as I have said, climate varies primarily with latitude. This is true specially of atmospheric temperature; but temperature varies also with altitude, or height above the level of the sea. To a less extent rainfall, the other great element of climate, varies with latitude, but the variation is much more irregular. More important in this case is the influence of the distribution of land and sea, and more especially the configuration of the land surface, the tendency here being sometimes to strengthen the latitude effect where a continuous ridge is interposed, as in Asia, practically cutting off "north-and-south" communication altogether along a certain line, emphasizing the parallel-strip arrangement running east and west to the north of the line, and inducing the quite special conditions of the monsoon region to the south of it. We may contrast this with the effect of a "north-and-south" structure, which (in temperate latitudes especially) tends to swing what we may call the regional lines round till they cross the parallels of latitude obliquely. This is typically illustrated in North America, where the angle is locally sometimes nearly a right angle. It follows, therefore, that the contrast of "east-and-west" and "north-and-south" lines, which I have here used for purposes of illustration, is necessarily extremely crude, and one of the most pressing duties of geographers at the present moment is to elaborate a more satisfactory method of classification. I am very glad that we are to have a discussion on "Natural Regions" at one of our sederunts. Perhaps I may be permitted to express the hope that we shall concern ourselves with the types of region we want, their structure or "grain," and their relative positions, rather than with the precise delimitation of their boundaries, to which I think we have sometimes been inclined, for educational purposes, to give a little too much attention.

Before leaving this I should like to add, speaking still in terms of "east-and-west" and "north-and-south," one word more about the essential east-and-west structure of the Old World. I have already referred to the great central axis of Asia. This axis is prolonged westward through Europe, but it is cut through and broken to such an extent that we may include the Mediterranean region with the area lying further north, to which indeed it geographically belongs in a discussion of this sort. But the Mediterranean region is bounded on the other side by the Sahara, and none of our modern inventions facilitating transport has made any impression upon the dry desert; nor does it seem likely that such a desert will ever become a less formidable barrier than a great mountain mass or range. We may conclude, then, that in so far as the Old World is concerned the "north-and-south" transport can never be carried on as freely as it may in the New, but only through certain weak points, or "round the ends," *i.e.* by sea. It may be further pointed out that the land areas in the southern hemisphere are so narrow that they will scarcely enter into the "east-and-west" category at all—the transcontinental railway as understood in the northern hemisphere

cannot exist; it is scarcely a pioneer system, but rather comes into existence as a later by-product of local east-and-west lines, as in Africa.

These geographical facts must exercise a profound influence upon the future of the British Isles. Trade south of the great dividing line must always be to a large extent of the "north-and-south" type, and the British Isles stand practically at the western end of the great natural barrier. From their position the British Isles will always be a centre of immense importance in *entrepôt* trade, importing commodities from "south" and distributing "east and west," and similarly in the reverse direction. This movement will be permanent, and will increase in volume long after the present type of purely "east-and-west" trade has become relatively less important than it is now, and long after the British Isles have ceased to have any of the special advantages for manufacturing industries which are due to their own resources either in the way of energy or of raw material. We can well imagine, however, that this permanent advantage of position will react favourably, if indirectly, upon certain types of our manufactures, at least for a very long time to come.

Reverting briefly to the equalization of the distribution of population in the wheat-producing areas and the causes which are now at work in this direction, it is interesting to inquire how geographical conditions are likely to influence this on the smaller scale. We may suppose that the production of staple foodstuffs must always be more uniformly distributed than the manufacture of raw materials, or the production of the raw materials themselves, for the most important raw materials of vegetable origin (as cotton, rubber, etc.) demand special climatic conditions, and, apart from the distribution of energy, manufacturing industries are strongly influenced by the distribution of mineral deposits, providing metals for machinery and so on. It may, however, be remarked that the useful metals, such as iron, are widely distributed in or near regions which are not as a rule unfavourable to agriculture. Nevertheless, the fact remains that while a more uniform distribution is necessary and inevitable in the case of agriculture, many of the conditions of industrial and social life are in favour of concentration; the electrical transmission of energy removes, in whole or in part, only one or two of the centripetal forces. The general result might be an approximation to the conditions occurring in many parts of the monsoon areas—a number of fairly large towns pretty evenly distributed over a given agricultural area, and each drawing its main food supply from the region surrounding it. The positions of such towns would be determined much more by industrial conditions, and less by military conditions, than in the past (military power being in these days mobile, and not fixed); but the result would on a larger scale be of the same type as was developed in the central counties of England, which, as Mackinder has pointed out, are of almost equal size and take the name of the county town. Concentration within the towns would, of course, be less severe than in the early days of manufacturing industry. Each town would require a very elaborate and highly organized system of local transport, touching all points of its agricultural area, in addition to lines of communication with other towns and with the great "north-and-south" lines of world-wide commerce, but these outside lines would be relatively of less importance than they are now. We note that the more perfect the system of local transport the less the need for points of intermediate exchange. The village and the local market-town will be "sleepy" or decadent as they are now, but for a different reason; the symptoms are at present visible mainly because the country round about such local centres is overwhelmed by the great lines of transport which pass through them; they will survive for a time through

inertia and the ease of foreign investment of capital. The effect of this influence is already apparent since the advent of the "commercial motor," but up to the present it has been more in the direction of distributing from the towns than collecting to them, producing a kind of "suburbanization" which throws things still further out of balance. The importance of the road motor in relation to the future development of the food-producing area is incalculable. It has long been clear that the railway of the type required for the great through lines of fast transport is ill-adapted for the detailed work of a small district, and the "light" railway solves little and introduces many complications. The problem of determining the direction and capacity of a system of roads adequate to any particular region is at this stage one of extraordinary difficulty; experiments are exceedingly costly, and we have as yet little experience of a satisfactory kind to guide us. The geographer, if he will, can here be of considerable service to the engineer.

In the same connexion, the development of the agricultural area supplying an industrial centre offers many difficult problems in relation to what may be called accessory products, more especially those of a perishable nature, such as meat and milk. In the case of meat the present position is that much land which may eventually become available for grain crops is used for grazing, or cattle are fed on some grain, like maize, which is difficult to transport or is not satisfactory for bread-making. The meat is then temporarily deprived of its perishable property by refrigeration, and does not suffer in transport. Modern refrigerating machinery is elaborate and complicated, and more suited to use on board ship than on any kind of land transport. Hence the most convenient regions for producing meat for export are those near the sea-coast, such as occur in the Argentine or the Canterbury plains of New Zealand. The case is similar to that of the "accessible" coalfield. Possibly the preserving processes may be simplified and cheapened, making overland transport easier, but the fact that it usually takes a good deal of land to produce a comparatively small quantity of meat will make the difficulty greater as land becomes more valuable. Cow's milk, which in modern times has become a "necessary of life" in most parts of the civilized world, is in much the same category as meat, except that difficulties of preservation, and therefore of transport, are even greater. That the problem has not become acute is largely due to the growth of the long-transport system available for wheat, which has enabled land round the great centres of population to be devoted to dairy produce. If we are right in supposing that this state of things cannot be permanent the difficulty of milk supply must increase, although relieved somewhat by the less intense concentration in the towns; unless, as seems not unlikely, a wholly successful method of permanent preservation is devised.

In determining the positions of the main centres, or rather, in subdividing the larger areas for the distribution of towns with their supporting and dependent districts, water supply must be one of the chief factors in the future, as it has been in the past; and in the case of industrial centres the quality as well as the quantity of water has to be considered. A fundamental division here would probably be into districts having a natural local supply, probably of hard water, and districts in which the supply must be obtained from a distance. In the latter case engineering works of great magnitude must often be involved, and the question of total resources available in one district for the supply of another must be much more fully investigated than it has been. In many cases, as in this country, the protection of such resources pending investigation is already much needed. It is worth noting that the question may often be closely related to the development and transmission of electrical energy from waterfalls, and the two problems might

in such cases be dealt with together. Much may be learned about the relation of water supply to distribution of population from a study of history, and a more active prosecution of combined historical and geographical research would, I believe, furnish useful material in this connexion, besides throwing interesting light on many historical questions.

Continued exchange of the "north-and-south" type and at least a part of that described as "east-and-west" gives permanence to a certain number of points where, so far as can be seen, there must always be a change in the mode of transport. It is not likely that we shall have heavy freight-carrying monsters in the air for a long time to come, and until we have the aerial "tramp" transport must be effected on the surfaces of land and sea. However much we may improve and cheapen land transport it cannot in the nature of things become as cheap as transport by sea. For on land the essential idea is always that of a prepared road of some kind, and, as Chisholm has pointed out, no road can carry more than a certain amount; traffic beyond a certain quantity constantly requires the construction of new roads. It follows, then, that no device is likely to provide transport indifferently over land and sea, and the seaport has in consequence inherent elements of permanence. Improved and cheapened land transport increases the economy arising from the employment of large ships rather than small ones, for not only does transport inland become relatively more important, but distribution along a coast from one large seaport becomes as easy as from a number of small coastal towns. Hence the conditions are in favour of the growth of a comparatively small number of immense seaport cities like London and New York, in which there must be great concentration not merely of work directly connected with shipping, but of commercial and financial interests of all sorts. The seaport is, in fact, the type of great city which seems likely to increase continually in size, and provision for its needs cannot in general be made from the region immediately surrounding it, as in the case of towns of other kinds. In special cases there is also, no doubt, permanent need of large inland centres of the type of the "railway creation," but under severe geographic control these must depend very much on the nature and efficiency of the systems of land transport. It is not too much to say (for we possess some evidence of it already) that the number of distinct geographical causes which give rise to the establishment and maintenance of individual great cities is steadily diminishing, but that the large seaport is a permanent and increasing necessity. It follows that aggregations of the type of London and Liverpool, Glasgow and Belfast will always be amongst the chief things to be reckoned with in these islands, irrespective of local coal supply or accessory manufacturing industries, which may decay through exhaustion.

I have attempted in what precedes to draw attention once more to certain matters for which it seems strangely difficult to get a hearing. What it amounts to is this, that as far as our information goes the development of the steamship and the railway, and the universal introduction of machinery which has arisen from it, have so increased the demand made by man upon the earth's resources that in less than a century they will have become fully taxed. When colonization and settlement in a new country proceeded slowly and laboriously, extending centrifugally from one or two favourable spots on the coast, it took a matter of four centuries to open up a region the size of England. Now we do as much for a continent like North America in about as many decades. In the first case it was not worth troubling about the exhaustion of resources, for they were scarcely more than touched, and even if they were exhausted there were other whole continents to conquer. But now, so far as our information goes, we are already making serious inroads upon the resources of the whole earth. One has no desire

to sound an unduly alarmist note, or to suggest that we are in imminent danger of starvation, but surely it would be well, even on the suspicion, to see if our information is adequate and reliable and if our conclusions are correct; and not merely to drift in a manner which was justifiable enough in Saxon times, but which, at the rate things are going now, may land us unexpectedly in difficulties of appalling magnitude.

What is wanted is that we should seriously address ourselves to a stock-taking of our resources. A beginning has been made with a great map on the scale of one to a million, but that is not sufficient; we should vigorously proceed with the collection and discussion of geographical data of all kinds, so that the major natural distributions shall be adequately known, and not merely those parts which commend themselves, for one reason or another, to special national or private enterprises. The method of Government survey, employed in most civilized countries for the construction of maps, the examination of geologic structure or the observation of weather and climate, is satisfactory as far as it goes, but it should go further, and be made to include such things as vegetation, water supply, supplies of energy of all kinds, and, what is quite as important, the bearings of one element upon others under different conditions. Much, if not most, of the work of collecting *data* would naturally be done as it is now by experts in the special branches of knowledge, but it is essential that there should be a definite plan of a *geographical* survey as a whole, in order that the regional or distributional aspect should never be lost sight of. I may venture to suggest that a committee formed jointly by the great national geographical societies, or by the International Geographical Congress, might be entrusted with the work of formulating some such uniform plan and suggesting practicable methods of carrying it out. It should not be impossible to secure international co-operation, for there is no need to investigate too closely the secrets of any one's particular private vineyard—it is merely a question of doing thoroughly and systematically what is already done in some regions, sometimes thoroughly, but not systematically. We should thus arrive eventually at uniform methods of stock-taking, and the actual operations could be carried on as opportunity offered and indifference or opposition was overcome by the increasing need for information. Eventually we shall find that "country planning" will become as important as town planning, but it will be a more complex business, and it will not be possible to get the facts together in a hurry. And in the meanwhile increased geographical knowledge will yield scientific results of much significance about such matters as distribution of populations and industries, and the degree of adjustment to new conditions which occurs or is possible in different regions and amongst different peoples. Primary surveys on the large scale are specially important in new regions, but the best methods of developing such areas and of adjusting distributions in old areas to new economic conditions are to be discovered by extending the detailed surveys of small districts. An example of how this may be done has been given by Dr. Mill in his 'Fragment of the Geography of Sussex.' Dr. Mill's methods have been successfully applied by individual investigators to other districts, but a definitely organized system, worked out on a carefully matured uniform plan, is necessary if the results are to be fully comparable. The schools of geography in this country have already done a good deal of local geography of this type, and could give much valuable assistance if the work were organized beforehand on an adequate scale.

But in whatever way and on whatever scale the work is done, it must be clearly understood that no partial study from the physical, or biological, or historical, or economic point of view will ever suffice. The urgent matters are

questions of distribution upon the surface of the earth, and their elucidation is not the special business of the physicist, or the biologist, or the historian, or the economist, but of the geographer.

REVIEWS.

EUROPE.

The Forth Valley.

'The Story of the Forth.' By H. M. Cadell. Glasgow: James MacLehose & Sons, 1913. *Maps and Illustrations.* 16*s. net.*

By a judicious blending of the popular and the scientific, Mr. Cadell has succeeded in producing an eminently readable volume of quite exceptional character. The author is not only a trained geologist with a keen eye for geographical processes, but also an extensive traveller and a busy man of affairs. His many interests are reflected in his book, which deals in part with the geological, in part with the geographical, and in part with the industrial history of the Forth valley. For him the story of the Forth begins in "the dark backward and abysm of time," when the geological foundations of the valley were laid, and the coal, iron, and shale deposits were accumulated which were later to bring prosperity to the southern shores of the Firth. The various agents by which Central Scotland has in course of time been sculptured into its present aspect are passed in review, and Mr. Cadell then presents in detail his hypothesis of the former extension of the Forth valley into the present basin of the Clyde. This portion of the book is practically a reprint of Mr. Cadell's article in the *Scottish Geographical Magazine* for May, 1912, which was noticed in these pages in the following month (*Geographical Journal*, vol. 39, p. 609). The main points of this hypothesis, which is based upon the author's careful work in the Dumbartonshire highlands, have never been disputed. Difference of opinion has arisen only with regard to the eastward or south-eastward flow of the original Clyde, and some discussion of the other hypotheses which have been suggested might have been profitably added by Mr. Cadell to the present restatement of his own position. The chapters in the book on the buried channels of the Forth and the old lochs of Edinburgh have also already appeared in the *Scottish Geographical Magazine.*

New ground is broken, however, in the latter portion of the book, which deals with the rise and development of the Scottish iron and mineral oil industries. The story of the Carron Co. is pithily told from its inception to its ultimate triumph over all its competitors in the east of Scotland. For the necessary historical details Mr. Cadell, whose ancestors were intimately connected with the Carron Co., has been able to draw upon much exclusive information, and the result is an important addition to the history of the industrial development of Scotland. The past vicissitudes of the Scottish mineral oil industry are also sympathetically recounted, and its present satisfactory position is hailed as one of the triumphs of modern science. The final chapters deal in an instructive manner with the possibility of reclaiming the bogs and mud flats which in places fringe the shore of the Firth, a practical matter to which the author has devoted considerable time and attention.

Mr. Cadell has brought together into a form convenient for reference much

scattered information of interest to the student of both physical and economic geography. His facts are everywhere clearly presented, and his own opinions and conclusions are expressed with characteristic vigour. The book is profusely illustrated by maps, photographs, and original sketches by the author, and altogether the volume forms an important contribution to Scottish geographical literature.

J. D. F.

ASIA.

The Geology of Palestine.

'Naturwissenschaftliche Studien am Toten Meer und im Jordantal.' Bericht über eine im Jahre 1908 (im Auftrage S.M. des Sultans der Türkei Abdul Hamid II. und mit Unterstützung der Berliner Jagor-Stiftung) unternommene Forschungsreise in Palästina. By Max Blanckenhorn. Berlin, 1912. Pp. vii., 478. 5 *Plates. Geological Map.* 106 *Figs. Price M.*24.

In 1907 the Sultan Abdul Hamid II. resolved to promote the scientific investigation of Palestine; he invited Dr. Max Blanckenhorn, who is well known for his researches in the geology of Syria and Egypt, to visit the country to study its geology and economic resources. It was also proposed that Dr. Blanckenhorn should enter the service of Turkey as head of a Geological Survey. Dr. Blanckenhorn spent the time from January to May, 1908, in a journey through Palestine. He landed at Jaffa, travelled thence to Jerusalem and the southern end of the Dead sea, and then southward along the continuation of the Jordan rift-valley, through the Wadi Araba, towards the Gulf of Akaba. He returned northward along the eastern side of the Dead sea, and up the Jordan valley to the Lake of Galilee, and to Haifa on the Bay of Acre. Returning thence to Constantinople, he spent the time from May to July arranging his collections in the Palestine Museum. The Turkish revolution, however, interfered with the further progress of the Sultan's admirable scheme. Dr. Blanckenhorn had to conduct a long lawsuit to secure the fulfilment of his agreements, and though his success in the law courts saved him from pecuniary loss, it could not relieve him from great trouble and anxiety.

The chief geographical and geological results of his journey have been published in three previous papers. In this volume Dr. Blanckenhorn prints the detailed journal of his geological observations, and gives a valuable map of the geology of Palestine; on it are marked numerous additions to the great fractures which have done so much to determine the relief of the country. The most important results of Dr. Blanckenhorn's journey were the discovery that some of the rocks to the south of the Dead sea, which had been previously regarded as Lower Carboniferous, are Cambrian, for he found in them specimens of *Paradoxides*. Dr. Blanckenhorn also added greatly to the known areas of the Miocene and Pliocene deposits in northern Palestine. He gives, amongst other things, an interesting account of the various phosphatic, asphaltic, and petroleum occurrences. He summarizes the previous researches on the phosphatic limestones, and concludes that the prospect of working them at a profit is still doubtful; he suggests that their working may have to be left for the future, when the value of phosphate may have increased.

Dr. Blanckenhorn has been a warm advocate of the former existence of a Pluvial period in the eastern Mediterranean, and he describes evidence of its influence in Palestine. He correlates the Pluvial period with the main glacial development in northern Europe; the beginning of the steppe and semi-arid climate of the present time he assigns to the early Palæolithic times, more

than 50,000 years ago. The existing climate, Dr. Blanckenhorn estimates, was completely established by the early Neolithic, about 10,000 years B.C.

One of the most important geographical results of Dr. Blanckenhorn's work is his addition to the knowledge of the crust-fractures in Palestine. He divides them into three chief series. The members of the oldest series either trend from east to west, such as those which formed the rift-valley to the north of Nazareth, or from north-west to south-east, such as that which forms the north-eastern scarp of Mount Carmel, or the parallel fractures in eastern Samaria. The second series trends from north-east to south-west or from north-north-east to south-south-west, and its age is assigned to the interval between the Upper Pliocene and the Pluvial period. This series includes some fractures which pass to the north of Damascus and others which traverse Samaria and eastern Judea. The third series trends north and south, and includes the faults which formed the rift-valley of the Jordan, and also the scarp which separates the highlands of Judea from the lowlands of Philistia. These meridional fractures are assigned to the "Middle Pluvial." They have been followed by later earth-movements, some of which happened in historic times.

Dr. Blanckenhorn's valuable memoir shows how greatly the structure of Palestine has been affected by recent earth-movements. The volume includes a zoological appendix, by J. Aharoni, of the Bezalel Museum at Jerusalem, on the animals observed and collected during the expedition.

J. W. G.

Northern Sumatra.

'Nord Sumatra. Bericht über eine im Auftrage der Humboldt-Stiftung der Königlich preussichen Akademie der Wissenschaften zu Berlin in den Jahren 1904–1906 ausgeführte Forschungsreise von Prof. Dr. Wilhelm Volz. Band II. Die Gajoländer.' Berlin: Dietrich Reimer (Ernst Vohsen), 1912. *Price, bound, M.*18.

The Gajo country, of which Prof. Volz treats in this second volume of his work,* is the interior of Atjeh, and has an area of fully 5000 sq. miles. About half the volume is taken up by a description of the author's journeys, and in the other half the geography, the geology, and people of the country are discussed. This part of Sumatra is occupied by several mountain ranges rising to heights of 10,000 or 11,000 feet. Whereas Java is the land of Tertiary deposits and volcanoes, while in southern Sumatra old sedimentary rocks are associated with them, and in middle Sumatra all the primary rocks except the archæan play an important part in mountain building, the last are most prominent in the north, and younger volcanic rocks are much less frequent. Gneiss and mica-schists occupy considerable areas, but the most widely distributed of the older rocks are a massive series of quartzite and clay-slates, the age of which cannot be determined with certainty as no fossils have been found in them, but which are probably in the main pre-Cambrian. Permo-Carboniferous rocks and Tertiary deposits are the other more important formations. The river system shows a remarkable parallelism, following the direction of the folds and probably determined by them, and Prof. Volz believes that the present configuration is due to a period of drought in Upper Pliocene times when detritus was accumulated in such masses that the rivers of the subsequent pluvial period were unable to remove it entirely. Even now droughts last for weeks in the interior of north Sumatra, and the vegetation contains forms unsuited to a damp tropical climate. Probably the change to a dry climate was due to a greater extension of land, the Malayan archipelago being during the upper Pliocene united

* Vol. 1 was reviewed in the *Journal*, vol. 37, p. 201.

to the continent, while Sumatra stretched much further into the Indian ocean. Hypsometrical and geological maps accompany the volume, which is also illustrated by a large number of photographs.

AFRICA.

Tribes of Kordofan.

'The Tribes of Northern and Central Kordofan.' By H. A. MacMichael. Cambridge: University Press. 1912. *Illustrations.* 10*s.* 6*d. net.*

This volume contains a vast amount of recondite and hitherto unpublished historical information, and will be of the utmost service to administrators and historians of the Sudan. The whole is put together with such skill that although the book deals with a large number of tribes, and is necessarily stiff reading, the successive chapters do not strike the reader as being in any sense forced into juxtaposition. Many valuable ethnological details are scattered throughout the book, but it must be recognized that Mr. MacMichael does not write as an ethnologist, and he has frankly passed by opportunities for raising and discussing interesting and important questions the answers to which are to be found in his volume.

The chapters on the Zaghawa and on the northern hills and Jebel Midob (in Darfur territory) are perhaps the most generally interesting. The information given under these headings sheds a flood of light on the penetration of northern Kordofan by the Nubians of Dongola and of the Nile valley north of that town. Vocabularies collected from the inhabitants of the northern hills of Kordofan show many similarities to the Barabra dialects. Such resemblances have been held by Keane and others to indicate that the Nubians (Barabra) of the Nile valley and of the hill men of Dar Nuba are of common origin, and this in spite of the utter diversity in physical and cultural characters of the two peoples. Now the inhabitants of the Jebel Midob say that they are the descendants of an ancient colony of Mahass and Danagla who travelled westwards from the Nile, and a party of Midobis told Mr. MacMichael that their fellows who had visited the river found that their language greatly resembled the Mahass and Danagla dialects. An examination of the Midobi vocabulary published recently by Mr. MacMichael in the *Journal of the Anthropological Institute* will show that this statement is in no way fanciful. Could clearer evidence be forthcoming? Surely it is obvious that the common features in the language of the Barabra and of the inhabitants of the hills of northern Kordofan, are due to the penetration, for the most part pacific, of the Nile Nubians (Barabra), a process of which ample evidence will be found in the pages of Rüppell, Pallme, and other travellers of the last century.

The book concludes with a number of appendices upon special subjects, among which is one summarizing our knowledge of those most puzzling of peoples, the Fung, and another dealing with a number of objects of Neolithic age found at Faragab, in northern Kordofan. C. G. S.

The Shilluk.

'The Shilluk People: their Language and Folklore.' By Diedrich Westermann. Philadelphia: Board of Foreign Missions. 1912. 10*s.* 9*d.*

This careful linguistic study of the Shilluk language is prefaced by an introduction giving a good general account of the people. There is, however, a curious error which, since it occurs both in the introduction (liv.) and in the text (122), is clearly not a slip, but is due to a misconception in the author's mind. A certain immigrant element in the population is persistently spoken of as

Nubian, and its name Don is even connected with Dongola. The account given of these people makes it reasonably certain that they are Nubas from southern Kordofan, and not Nubians from the Nile valley north of Khartum. Further, the Jebel Dyre of Bruce should not be identified with Jebel Eliri in southern Kordofan (liv.), and it is difficult to see why the author should have avoided the commonly accepted view that Bruce's Dyre is Jebel Daier in northern Kordofan.

These criticisms having been made, there remains nothing but unqualified praise for the book. A large amount of valuable ethnographical information will be founnd in the texts and stories which make up nearly half the book, though this, it must be remembered, is written by a philologist, not by an ethnologist. In a chapter on phonetics Prof. Westermann shows how important is the part played by tone in the Shilluk language, and he distinguishes a middle as well as a high and low tone, the former being the least easily recognized. The Shilluk language belongs to the clearly circumscribed group of African languages styled "Nilotic," which probably have arisen from the "Sudan" group, extending across the continent from Abyssinia to the Kamerun and northwards to Senegambia. Shilluk and the other Nilotic languages differ from these especially in having grammatical gender and many formative elements. Five criteria of the Nilotic languages are given, and they are grouped in two main subdivisions, viz.—

(*a*) The Niloto-Sudanic group, and

(*b*) The Niloto-Hamitic group.

Although there is no sharply defined boundary between these divisions, since they both contain elements of "Sudan" and Hamitic origin, they can be distinguished in practice by their resemblance to the Sudan and Hamitic languages respectively.

To the Niloto-Sudanic group belong Shilluk with its dialects, about a dozen in number, Dinka and Nuer, while a number of tribes, the Mittu, Madi, Abokaya, Abaka, Luba, Wira, Lendu, and Moru, seem to form a subdivision of the Niloto-Sudanic group, although their vocabularies vary considerably from those of the Shilluk and Dinka languages. The importance of this conclusion from the ethnological standpoint is very great, since it affords positive evidence of the existence of Hamitic influence among the comparatively short, mesaticephalic population of the watershed between the Bahr-el-Ghazal and Congo, sufficiently intense to so modify their languages that they can no longer be classified with the parent "Sudan" linguistic stock.

C. G. S.

Fossil Hunting in East Africa.

'Am Tendaguru. Leben und Wirken einer deutschen Forschungsexpedition zur Ausgrabung vorweltlicher Riesensaurier in Deutsch-Ostafrika.' Von Dr. Edw. Hennig. Mit 62 Abbildungen im Text, 8 schwarzen, 1 farbigen Tafel und 1 Kartenskizze. Stuttgart: E. Schweizerbart'sche Verlagsbuchhandlung. 1912. Pp. 151. *Price M.*4; *bound*, *M.*4.80.

Dr. Hennig went out with Prof. W. Branca to dig out remains of extinct saurians on the Tendaguru hill, near the right bank of the Mbenkuru river in German East Africa. The remains were first discovered by an engineer, Herr B. Sattler, and Prof. Fraas, who was then in the country, obtained some valuable material, and the expedition of Prof. Branca went out to complete the work. The bones of the Dinosaurians were found mingled with small bones of a softer material, which might belong to fossil birds or flying lizards,

wood of land-plants, and remains of animals which undoubtedly lived in water. They must, therefore, have been carried hither and thither in water until finally deposited where they were found. They occur at three different levels, and the shells present with them will probably give a clue to their geological age. The saurians surpass in dimensions those discovered in America. The humerus of the plaster cast of an American *Diplodocus* in the Berlin Museum measures 0·95 metre (37½ inches), whereas the largest found on the Tendaguru is more than 82½ inches long. The length of the neck of the Berlin *Diplodocus* is about 23 feet, that of the Tendaguru more than 39. The rump and tail vertebræ, however, correspond in size to the American, so that the Tendaguru animal cannot have been nearly double as long, as the proportions of the other bones would imply.

Dr. Hennig has also written chapters on the existing fauna and flora, the inhabitants, their habits and mode of life, etc.

'In the Heart of Savagedom.' By Mrs. Stuart Watt. (London: Marshall Bros. [Not dated; 1913.] *Illustrations.* Pp. 472. *Price* 7*s.* 6*d. net.*) A record of over twenty-five years' heroic missionary labour in Central Africa. The author and her husband (who edits the work) went out, apparently at their own expense, in 1885, and began work at Mamboia, in the Ugogo region of German East Africa, where they remained some years, but eventually abandoned the station owing to failure in health. They returned to the mission field, however, and, after an attempt to found a station among the Wa-kikuyu, fixed on Akamba as their field of operations. The natives at first made attempts to plunder and murder them; but gradually a better understanding was arrived at, and a flourishing mission, self-supporting through its fruit plantations and other activities, built up. The author narrates her experiences in a plain, yet readable manner; and though her views may not meet with universal acceptance, yet the simple sincerity of the narrative and quiet courage displayed throughout make their own appeal. The illustrations are mostly good, but there is no index.

'In French Africa.' By M. Betham-Edwards. (London: Chapman & Hall. 1912. Pp. x., 324. *Illustrations.* 10*s.* 6*d.*) The title of this volume leaves something to the imagination; the book is concerned actually with Algeria. It contains a readable narrative and impressions of a number of well-known places in that territory, and of some which visitors there seldom reach.

'The Adventures of an Elephant Hunter.' By James Sutherland. (London: Macmillan. 1912. Pp. xviii., 324. *Illustrations.* 7*s.* 6*d.*) The title describes the greater part of the text exactly, and sufficiently stirring some of the adventures are. We find incidentally some notes as to native customs and the like, from the hunter's special point of view, and a useful appendix refers to water-bearing plants, edible fruits, plants serving other purposes, etc.

AMERICA.

'Labrador. The Country and the People.' By W. T. Grenfell, C.M.G., M.D., and others. New Edition. (New York: The Macmillan Co. 1913. Pp. xii., 529. *Map and Illustrations.* 10*s.* 6*d. net.*) Dr. Grenfell has brought out a new edition of his excellent and comprehensive work on Labrador (see *Geographical Journal*, vol. 36, p. 725). A useful bibliography has been added, and a new chapter on the natural history of the land mammals, and the author briefly discusses the future of Labrador. With a decrease in almost all the land and sea animals, the prospects are none too bright, but Dr. Grenfell refuses to think

pessimistically of his adopted land. Immense water-power and vast pulp lands are yet entirely undeveloped, the waste products of the fisheries will be utilized and cold storage introduced to improve the value of the exports. The farming of fur-bearing animals is beginning, and should prove highly remunerative, while every year prospectors are seeking for gold, though its discovery might be a doubtful blessing to Labrador.

Panama Canal. What it is and what it means. By John Barrett. (Washington: Pan-American Union. 1913. Pp. 120. *Maps and Illustrations.* $1. This is a useful little handbook to the isthmus of Panama and the canal designed for tourists and others who desire condensed information on the subject. Mr. Barrett, who has had extensive experience as United States Minister to various American lands and is now Director-General of the Pan-American Union, writes with unalloyed enthusiasm not only of the canal and its future, but what he is pleased to describe as "Uncle Sam's work" in the canal zone. He wants "the tropics and Panama to get a square deal," and he believes the completion of the canal will signalize the opening of a Pan-American era. The style is vivacious if a little egotistical, and includes a liberal allowance of American slang, such as "insect devil" and "malarial-bearing bird" as synonymous with mosquito, and expressions such as "quite a little east of south;" but why should Vasco Nuñez de Balboa be modernized to the extent of being referred to as Mr. Balboa? There are many good illustrations, but it is unfortunate that the maps to show the relations of the canal to trade routes should have been drawn on Mercator's projection. The bibliography is almost exclusively of American books.

AUSTRALASIA AND PACIFIC ISLANDS.

New Zealand Geology.

'Geology of New Zealand.' By P. Marshall. Wellington: 1912. Pp. viii., 218. *Map*, 112 *Figs.*

The 'Geology of New Zealand,' by Prof. P. Marshall, is mainly a synopsis of the principles of geology, especially on its geographical side, as illustrated by New Zealand examples. It should, therefore, prove to students in New Zealand a most valuable supplement to the standard text-books. It may also be read with profit outside that country, owing to its statements by one of the ablest of New Zealand geologists as to the applicability of current theories to the local evidence. The book gives no references to literature, and mentions very few authorities, while the section on the historical geology of the country, which to readers outside New Zealand would be of most interest, is very brief. The book is therefore written on very different lines from Prof. Park's text-book. One striking feature in the author's stratigraphical summary is that he does not accept the occurrence of any Devonian or Carboniferous rocks in New Zealand. The Maitai series he regards as Triassic, and perhaps partly Jurassic. No doubt much of the Maitai belongs to those two systems, but Prof. Marshall offers no adequate explanation of the presence of Carboniferous brachiopods in these rocks. That the Maitai includes some Carboniferous strata still seems the safest conclusion.

The author states that "too much attention has been paid in the past to the palæontological evidence" (p. 197). No such complaint could be made against this book, for it omits reference to the palæontological evidence which controls the correlation of some New Zealand rocks.

The work begins with an interesting summary of the physical features of the

ocean floor in the New Zealand area, and the sketch-map brings out the fundamental importance of the ridges running from north-north-east to south-south-west, from Samoa to New Zealand and along it, and of another series at right angles to the first, including the long north-western peninsula of the north island.

As Dr. Marshall is an expert petrographer, his account of the varied igneous rocks of New Zealand will be read with special interest. It is worthy of note that he concludes that no effects of petrographic differentiation have yet been recognized in New Zealand. He adopts the view that most of the water which escapes from the hot springs is of "juvenile" origin, and dismisses its supposed origin from rain-water, a view which he remarks has "yet some supporters" (p. 114).

The book is issued by the Minister of Education in New Zealand. Among its many valuable contributions is an excellent coloured geological map of New Zealand, which will replace the long-used map by Hector.

J. W. G.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

Valley Steps.

'Taltreppe. Eine Geologisch-Geographische Darstelling.' Von V. Hilber, Professor an der Universität in Graz. Graz: Deutsche Vereins-Druckerei. 1912. *A map and three views.* Pp. 50. *Price M.*2.50.

By the term *Taltreppe* the author denotes the series of terraces and shelves in a valley, whether longitudinal or transverse. He describes twelve such terraces in the neighbourhood of Graz, six of which he assigns to the Tertiary age, while five are of diluvial origin and one of alluvial. They range from a height of 1150 feet up to 4720 feet. The causes of the formation of the terraces of accumulation, *Baustufen* in Prof. Hilber's nomenclature, and erosion terraces, *Grundstufen*, are fully described, and the period of their origin is discussed. No small part of the book is occupied with controversial matter, the views of Profs. Penck and Brückner being the object of attack. Prof. Penck ('Die Alpen in Eiszeitalter') has found that the terraces in Alpine valleys very frequently adjoin terminal moraines, and are dovetailed into them, and must therefore be of the same age. Valley terraces, however, occur in countries which have never been glaciated, and Prof. Hilber has found terraces below moraines consisting entirely of water-worn pebbles, while Böhm and Heritsch speak of moraines overlying the terrace pebbles. If, however, his opponents refer only to the fans immediately below the moraines, Prof. Hilber does not dispute the glacial origin of their material. He also differs from the two professors as to the time when the terraces were formed. He has found large accumulations of detritus dating from the Pliocene age, and holds that the diluvial terraces were more probably formed in interglacial periods rather than in glacial periods, when the greater rainfall would swell the rivers and carry off the detritus, whereas Prof. Penck holds that when glaciers reached their greatest extension erosion was greater and the rivers deposited their load. Other subsidiary questions are also discussed.

Plant Geography.

'An Introduction to Plant Geography.' By M. E. Hardy, D.Sc. Pp. 192. Oxford: Clarendon Press. 1913. *Maps and Illustrations.* 2*s.* 6*d.*

This latest volume of the Oxford Geographies is very welcome. No one could be better qualified than Dr. Hardy to write such a volume, and its want was much felt by teachers. At the basis of all human geography must always lie the study

of vegetation as the link with the purely physical aspects of the subject, and it is to be hoped that this cheap and lucid volume will emphasize to teachers the importance of dwelling on the vegetation of countries studied. The Oxford Press has already supplied excellent wall maps, and this volume will serve to interpret them. The main vegetations of the globe are described in the greater part of the book and abundantly illustrated. The factors controlling plant-life are then briefly treated, and lastly there is a survey of the continents with vegetation maps of each. Many of the illustrations are photographs; the others are drawings not all of equal merit.

'Ordnance Survey Maps: their meaning and use.' By M. I. Newbigin, D.SC. (Edinburgh: W. & A. K. Johnston. 1913. Pp. 126. 1*s. net.*) Miss Newbigin has produced a useful little volume which ought to be widely used in schools. After some preliminary chapters on map reading follow descriptions of eight representative 1-inch Ordnance Survey sheets, as examples to the teacher and the pupil of the use and interpretation of maps. Brief references to literature relating to each are given. No other book in English covers this ground except Salisbury and Atwood's volume, which refers to American maps, and is, moreover, more expensive. It is to be hoped that some arrangement can be reached with the Ordnance Survey to make moderate quantities of these eight sheets available for schools at a reduced price.

'Volcanoes: their structure and significance.' By T. G. Bonney, D.SC., LL.D., F.R.S. (3rd edit. London: Murray. 1912. Pp. 379. *Illustrations.* 6*s. net.*) This new edition of Dr. Bonney's well-known book has been added to by notice of the more recent volcanic eruptions, while the chapter on the theories of volcanoes has been considerably altered in the light of more recent knowledge. In the map showing the distribution of volcanic areas we cannot agree with the course of the Andean line of weakness which is drawn across Drake strait to the South Shetlands and then eastward to the South Sandwich group. Nor is there any indication of a line of weakness along Graham Land. In the text also some of the references to the Antarctic are not brought up to the most recent research. There is, for instance, no mention of Gaussberg, which in view of its isolation among unexplored land is most important, and the German work in Kerguelen is not referred to. On p. 261 the greatest depth of the *Challenger* deep in the Pacific is wrongly given. One or two mistakes are also noticeable in the index.

R. N. R. B.

GENERAL.

A Forgotten Navigator.

'Commodore Sir John Hayes, his Voyage and Life (1767–1831), with some account of Admiral d'Entrecasteaux's Voyage of 1792–3.' By Ida Lee (Mrs. Charles Bruce Marriott). London: Longmans, Green & Co. 1912. *Maps, Charts, and Illustrations.* 7*s.* 6*d.*

Mrs. Marriott has done useful work in putting together from scattered and not easily accessible sources a fairly good life-history of Sir John Hayes, who was born in 1767, in his thirteenth year (1781) joined the Bombay marine and the East India Company, thereafter did fifty years of excellent work for this company and for the nation, but has yet been so far forgotten that his name finds no place in the 'Dictionary of National Biography.'

One parergon which Mrs. Marriott has rightly and greatly credited to this worthy old servant of the Company is of especial interest to geographers. Hayes,

in 1793–4, was the leader of an adventure—which if not discouraged was at least not encouraged by the company—during the course of which the two British ships the *Duke of Clarence* and the *Duchess* started from Calcutta, circumnavigated Australia, did some early—though not earliest—exploration of Tasmania, then still thought to be "the Southern Cape of Australia," entered, almost certainly for the first time, between the barren reef and the mainland of the western coast of New Caledonia, thence passed northward through the Louisiade archipelago, and made an attempt, so vigorous that it deserved—though it did not attain—permanent success, to establish a first English settlement in New Guinea (at Dore harbour on the north-west coast).

It is most unfortunate that Hayes' journal of this voyage has been lost, and it is greatly to be hoped that, as Mrs. Marriott suggests as possible, it may still be found and published. For it may safely be assumed that this lost record would establish Hayes' claim—now doubted in some quarters—to have been the first to make certain detailed geographical investigations which he claimed for himself or others claimed for him.

Hayes was very unfortunate in the exact time of his adventure, for, though he knew it not, he was just, but only just, preceded in almost every place he examined by others, by the French Admiral D'Entrecasteaux (of whose doings of this kind Mrs. Marriott gives an excellent account) in Tasmania and New Caledonia, and by one of his own fellow-servants of the East India Company, Captain Forrest, in New Guinea. Much more is on record of D'Entrecasteaux and of Forrest's exploits than of Hayes'; but it seems now fairly clear that Hayes, though he was not really the first to explore these places, did make many detailed discoveries which escaped the notice of the others.

Mrs. Marriott has done so much to recover for us the story of Hayes' adventure that it is perhaps ungracious to ask her for more; but the extracts and notes from the family and other MS. sources from which she has derived her information are so interesting that one cannot help wishing that these documents might be published more in full.

The illustrations, especially the charts, are exceptionally useful; and the index, though not perfect—how seldom indexes are perfect!—is at least of average goodness.

E. IM. T.

Educational Books.

'World Studies. Book 1: Dent's Historical and Economic Geographies.' By Horace Piggott and Robert J. Finch. (London: J. M. Dent & Sons, Ltd. Pp. xxiii., 390. *Maps, etc.* 3*s.* 6*d.*) The authors dip into many sciences which are kindred to geography, in order to explain the evolution of the Earth, its preparation as the home of man, the growth of the human species, and the expansion of the known world until it included the whole globe. Section IV., for example, recounts the story of man on the Earth from the earliest times to the Bronze Age in approximately fifty pages, with illustrations of human relics, and some fanciful pictures which are reproduced from Knipe's 'From Nebula to Man.' The teacher will find in this book, in brief, much matter which the authors deem relevant as an introduction to the more serious study of geography promised in the succeeding volumes of the series.

'An Elementary Historical Geography of the British Isles.' By M. S. Elliott. (London: A. & C. Black. 1913. Pp. x., 172. *Maps, etc.*) The plan of this work is due to Prof. Lyde. A large portion of the book is presented in a fashion which will be familiar to students of economic history, and here the reader is left to work out the geographical connection very largely for himself. The

geographical basis of the history is developed at intervals and very unequally. England, for example, is considered as composed of five regions, of which the first is the Chalk sheet of the south-east, and the last Northern England. Many paragraphs are given to a description of the Chalk sheet and of its effect upon man in prehistoric, Anglo-Saxon, mediæval, and modern times. On the other hand, the North of England section dismisses the Lancashire plain in seven lines. This difference of treatment suggests the keynote of the book—history as history with some geography. Teachers still await the text-book which gives the historical development of a district such as south-east Lancashire so as to emphasize those peculiarly geographical elements which have contributed to the progress of the region, until it has become for its size probably the most important region in the wide world.

'A Geography of the British Empire.' By A. J. Herbertson and R. J. Thompson. (The Oxford Geographies: Clarendon Press. 1912. Pp. 256. *Maps.*) Nearly half of this book deals with the British Isles, and our own islands as well as the separate parts of the empire are described on a consistent plan with that careful attention to cause and effect which one is accustomed to associate with the name of Prof. Herbertson. In style and technique the book maintains the characteristic features of the series. One misses, however, references by way of contrast or comparison from one part of the empire to another; each section of the book might easily be published as a separate work.

'A Practical and Experimental Geography.' By Frederick Morrow and Ernest Lambert. (London: Meiklejohn & Son. 1913. Pp. xiv., 230. *Maps, etc., exercises.* 2*s.* 6*d. net.*) The first third of this book deals with plans, compass directions, field surveying, measurements of heights and distances by means of simple methods, and simple instruments. This is outdoor work. The next fifty pages deal with contours, and lead to the interpretation of Ordnance maps. Twenty-five pages are then occupied with the problem of latitude and longitude. Thus, almost another third is devoted to map-work, and most of this work can be performed in the classroom. The barometer, rain-gauge, etc., are next considered, in order to facilitate the reading of weather reports, etc., and the final chapters deal with the size and shape of the Earth and its motions, and with the sun and moon. The explanations and diagrams are clear, the exercises are numerous; but one wonders how the authors interpret the term "experimental" in the title.

B. C. W.

'Notes and Queries on Anthropology.' (London: Royal Anthropological Institute. 1912. Pp. xii., 288. 5*s.*) This fourth edition has been edited by Miss Freire-Marreco and Prof. J. L. Myres, under a committee of the British Association, which has been identified with the work since the first issue in 1874. The Royal Anthropological Institute, however, undertakes the distribution and sale. A very extensive revision has been applied, and the work will be found of value in many directions to geographers, who, in the direction of human study, will find it a useful adjunct to the 'Hints to Travellers.'

'The Origin of Earthquakes.' By C. Davison. (Cambridge: University Press. 1912. Pp. viii., 144. *Maps and Illustrations.* 1*s.*) This volume of the Cambridge Manuals of Science and Literature is admirable in style as a plain exposition of the causes of earthquakes and the phenomena accompanying them. No part can fail to be intelligible to the general reader. The maps also are excellent, except when they are paradoxically so far simplified as to be somewhat difficult to read.

THE MONTHLY RECORD.

ASIA.

Sir Aurel Stein's New Expedition.—We are pleased to announce that, with the sanction of the Secretary of State, Sir Aurel Stein has undertaken an important new expedition into Central Asia, which he expects to occupy him for close on three years. The geographical, no less than the archæological, objects of the expedition have been officially recognized, and further valuable results may be expected from this point of view. Proceeding to Chinese Turkestan by a hitherto unexplored route, the traveller hopes to be in time for a winter campaign in the desert, afterwards extending his work further east towards the western borders of China. We hope to enter into fuller details in the next number of the *Journal*.

The Old Course of the Oxus.—The long-sustained controversy on the former course of the Oxus towards the Caspian sea has once more been reopened within recent years, after having to all appearance been laid at rest through Russian and other research about the nineties of last century (cf. *Proc. R.G.S.*, 1892, p. 236; *Journal*, vol. 1, p. 64). The latest contribution is that of Dr. A. Hermann, a keen student of the early history and geography of Central Asia, in the August number of *Petermanns Mitteilungen* for 1913. It was suggested by an important study by Dr. K. Barthold, originally published in Russian in 1902, and lately made more generally accessible by issue in German, in a revised and extended form, in the second volume of Stübe's 'Quellen und Forschungen zur Erd- und Kulturkunde' (Leipzig, 1910). While fully recognizing the value of Dr. Barthold's study, Dr. Hermann has views of his own on certain parts of the question, and shows reason here and there for dissenting from some of his predecessor's conclusions. The researches of Konshin, Walther, and others towards the close of last century had thrown serious doubts on the existence at any time of an arm of the Oxus reaching the Caspian by way of the Uzboi, until Barthold placed the question on a new footing by showing that, whereas all the reports dating from the fourteenth and fifteenth centuries A.D. which spoke of the Oxus as debouching into Lake Aral only were almost literal transcripts from tenth-century authorities, all the independent sources of that period agree in mentioning a connection with the Caspian. There is, therefore, a strong case for the view that such existed, and the chief point remaining obscure is that of the exact channel by which the connection took place. The arm which entered the Sary-kamish lakes is put out of court by a study of levels, and whether the Oxus water found its way to the Uzboi by a channel leaving the Sary-kamish arm below its divergence from the Aral branch, or by an independent channel further south, cannot at present be decided. Since Walther failed to find any trace of river deposits in the Balkhan bay of the Caspian, the probability seems to be that the mouth was further south, in the Koshu-odek bay. As regards the time through which the discharge into the Caspian was maintained, Hermann goes further than Barthold in believing that the channel carried water not only in the middle ages, but also in antiquity. He regards the statements of Herodotus and Strabo as based, independently, on the same original authority, and holds that, though the former obscures the issue by confusing the Oxus with the Araxes, his mention (like that of Strabo) of a discharge into the Caspian really applies to the Oxus. The connection, in his view, was broken about the second half of the fifth century A.D., but was re-opened in the thirteenth century owing to the destruction of dams on the Aral arm by the irruption of the Mongols. It was

then maintained till at least towards the end of the sixteenth century, and seems to have been finally closed, by artificial means, only about 1603. The modern branch of the Oxus debouching into Lake Aral has no doubt always existed, the changes relating merely to the amount of water carried by it according to the state of the training works near Sheikh-abbas-bali or Bi-bazar.

AFRICA.

Early Description of the Nile Delta.—In the April number of the *Journal of the Royal Asiatic Society*, Mr. A. R. Guest prints for the first time an Arabic description of the Nile delta extracted from an unique manuscript on geography preserved at the British Museum. The catalogue of the Museum Library ascribes the work to Ibn Serapion, but this seems a mistake, the compiler's name being given as Guhrab in the manuscript itself. After describing the course of the river to the south, the manuscript states that the Nile passes Misr (Old Cairo), and that seven arms spring off from it afterwards, each being described in turn. Three are regarded as principal arms, viz. the westernmost, debouching at Alexandria; the easternmost, probably passing Bilbais and debouching at Farama (Pelusium); and an intermediate one, corresponding in part with the existing eastern arm, but debouching not at Damietta, which is placed at the mouth of a secondary branch, but at some spot which cannot be identified. It is remarkable that no direct mention is made of any channel representing the Bolbitine arm, the present main outlet near Rosetta. The separation between the main western and the central (present eastern) arm is apparently placed a good deal above Shatanuf, the point of bifurcation in the tenth century (and probably earlier). From this circumstance, and the fact that none of the early Arab geographers mention the Pelusian arm, which makes it improbable that it can have been of importance in the tenth century, Mr. Guest considers that the original authority for the description is to be referred back to a time before the ninth century, though the geography was not compiled till the tenth. Incidentally the description of the delta throws a little light on the position of Saradus (placed on the central main arm of the delta), and its canal.

Effect of the Mediterranean on the Climate of Egypt.—In the May number of the *Cairo Scientific Journal*, Mr. J. I. Craig compares the records of air-temperature at Alexandria with those of the sea-temperature in the adjacent parts of the Mediterranean (the latter having been supplied to him by Captain Campbell Hepworth of the British Meteorological Office) with a view to tracing the effect of the sea to the north on the temperature in Egypt. He makes the comparison, firstly, with the sea to the immediate north, bounded by the parallel of 32° and the meridians of 30° and 32° E., and, secondly, with the Southern Levant in general, as, in the lack of sufficient observations in the former case, a less doubtful value of the mean could be obtained by extending the area of observation. The inquiry is also extended to include the inland station of Abbassia. As might be expected, the comparison brings out clearly the control exercised by the sea, and the following points emerge. The mean temperature at Alexandria is higher in winter than at Cairo, being raised by the influence of the relatively warm sea-water whenever the wind blows from the sea. The maxima and minima at Abbassia precede by about fifteen days those at Alexandria, which again precede those of the sea by from ten to fifteen days; the lag being due, of course, to the relative slowness with which the water absorbs and gives out heat. The comparative dampness of the climate in the latter part of the year is another effect of the neighbouring sea, the warmer air

from the latter having its temperature lowered by about a degree when it blows on to the land, the relative humidity being increased in consequence by about 5 per cent. In the early months of the year the effect is reversed. The fact that the temperature correlation is greater for mean than for minimum temperature is again to be explained by the action of the wind, which shows a marked diurnal variation in velocity. At night the air-temperature is more dependent on nocturnal radiation than on the influx of air from the sea to the north. The paper is accompanied by tables setting forth the temperature data and various correlations.

New Port and Railway for Nigeria.—An important step in railway construction in Nigeria has, it is announced, been lately decided on, and will be pushed forward under Sir F. Lugard's administration. This is the building of a new trunk-line from the Niger delta to the Udi coal-fields (east of the lower Niger in the latitude of Onitsha), thence to the Benue river, which will be crossed by an important bridge, and on along the border of the Bauchi highlands to the Kaduma, where it will be linked with the existing railway. It will pass near the tin-fields, to which a branch line may eventually be constructed. A particularly favourable site for its seaward terminus has, it is said, been secured through the recent discovery of a previously unvisited creek, apparently a branch of the Bonny river, by Lieut. Hughes, R.N.R., of the Government yacht *Ivy*. From this rises a precipitous cliff 45 feet in height, with 50 feet depth of water alongside—a condition unknown elsewhere in this part of Africa, where the shallow mangrove swamps have been a serious obstacle to development. This favourable conjunction will be utilized for the construction of a town with wharves, railway shops, and all other requisites for commercial activity, and it is expected that the port will become the great coal-distributing centre for the whole of West Africa. The railway will be 550 miles in length, and the work of construction is expected to occupy four or five years. The natives in the vicinity of the port (which will be known as Port Harcourt) are reported to be cannibals, and the railway will pass through the main strongholds of Juju worship, which it should do much to eradicate.

The Annual Rise of the Niger.—The first number for 1913 of the *Annales de Géographie* contains an elaborate discussion by Lieut. J. A. Millot on the *régime* of the Niger and its annual rise, based on all the data that have so far accumulated, which is useful in view of the little that is definitely known on the subject. The writer begins by pointing out the sharp division of the Niger basin into three subdivisions, two of which, in his terminology, are basins of supply, the third a basin of absorption. The first basin of supply extends from the ultimate headstreams of the upper Niger and its tributary, the Bani, to points on these rivers in about 14° N. lat., and the second extends from Ansongo on the middle course of the river to the sea, including the country drained by the Benue and other tributaries in this section. In the first, the stream starts from a region of excessive rainfall and passes successively through zones of less and less rainfall; in the second the order is precisely reversed. The basin of absorption embraces the middle section of the Niger, with the lacustrine region in the neighbourhood of Timbuktu; in this no appreciable amount of rain falls. The generally impermeable nature of the formations in the basins of supply bring it about that the rains exercise a preponderating influence on the *régime* of the flood. Other points discussed are the angle of fall of the bed of the river and the general characteristics of this at low, mean, and high water. Speaking generally, the fall is remarkably slight, and the propagation of the flood is therefore slow. On the other hand, the form of the bed is well adapted

to the function it has to discharge, and is remarkably uniform and stable, so that the fall is the determining factor in the behaviour of the flood. In accordance with the complete separation between the two basins of supply, there are two distinct sources of the annual rise, a western and an eastern, and by reason of the time occupied in the propagation downstream of the western rise, its effect is not fully manifested on the lower river until after the eastern rise has begun to subside. The author discusses in detail, with the aid of curves, the dates at which the effect of the two rises manifests itself, in its various stages, in successive sections of the river's course, bringing out also the way in which the propagation of the western rise is regulated by the region of swamps and lakes of the central basin. He distinguishes graphically the relative proportions of the rise in the lower basin which are to be ascribed to the western and eastern rains, showing how, as regions of earlier and more copious rainfall are reached, the eastern flood assumes greater and greater importance relatively to the western, though this has an important effect in maintaining the level after the effect of the eastern flood has diminished. There seem to be indications of a certain regular variation in the extent of the rise from one year to another, though the data are not yet sufficient to establish this.

AMERICA.

Return of Dr. Hamilton Rice.—In the *Journal* for June last, p. 589, we gave the substance of letters from this traveller, bringing the account of his experiences down to January of this year. He had expected to reach Manaos, at the mouth of the Rio Negro early in the past summer, and the absence of all news down to a recent date had begun to cause some slight uneasiness. This has now been happily removed by his return to civilization, reporting the completion of a successful journey. Reaching the source of the Inirida on February 16, he descended this river to the Pafunaua, ascended the latter to near its source, and then, crossing the swamps to the source of the Isana, descended this to the Rio Negro, and reached San Felipe early in August. Among other results he has fixed the source of the Guainia with comparative accuracy, and says that, coupled with the results of his former journey, his new observations enable him to pretty well clear up the geography of the north-west Amazon basin between the Guaviare, Caqueta, and Rio Negro—roughly an area of 75,000 square miles. In addition to the extensive series of observations for the determination of position, he has secured many interesting medical, anthropological, and ethnological *data*.

Reported Murder of an American Explorer in Northern Canada.—A report has reached the headquarters of the Canadian North-West Mounted Police that the American naturalist, Mr. Harry V. Radford, and his companion, Mr. Street, of Ottawa, were murdered last year by Eskimo in Northern Canada. Reference was made to the earlier stages of Mr. Radford's journey in the *Journal* for April, 1912, and further information, derived from letters sent home by the explorer, has since been given in the *Bulletin* of the American Geographical Society (1912, p. 608; 1913, p. 134). Writing in December, 1911, from his winter quarters at the head of Schultz lake, Thelon river (see Mr. Hanbury's map in *Journal*, vol. 16, p. 140, and Mr. J. W. Tyrrell's report summarized in vol. 20, p. 340), Mr. Radford reported that he had received the supplies forwarded him by the Arctic Club of New York at the mouth of the Chesterfield inlet in September of that year, but that, the small schooner in which he had navigated the inlet and the river at its head as far as Baker lake having been beset by ice, he had made his way with half the supplies only, in sledges, to the Eskimo encampment on Schultz lake. He had so far been unable

to persuade any of the Eskimo to accompany him on his proposed northern journey. In March, 1912, he wrote to the effect that he and Mr. Street were about to start for Bathurst inlet on the Arctic coast with three Eskimo and two sledges, and that they hoped to reach their destination in six weeks. From the reports received it appears that they had already reached Bathurst inlet, the coast of which Mr. Radford hoped to survey, but that the two white men were there murdered as the result of a quarrel with their Eskimo companions. This is said to have been about June 5, 1912. Mr. Radford speaks in his letters of a good deal of exploring work having been done, especially by Mr. Street, in addition to the collection of mammals and birds, ethnological studies, and meteorological observations. No details as to the routes followed appear, however, to have been received in the United States.

Physical History of the Russian River, California.—The Russian river, a characteristic stream of the California coast range, takes a remarkable course to the sea in its lower valley, the explanation of which offers an interesting problem, and one which has an important bearing on the whole physical history of the region. The problem is discussed by Mr. R. S. Holway in the *University of California Publications in Geography*, vol. 1, No. 1 (1913). The Russian river, one of the major streams of the Californian coast ranges north of San Francisco, flows in a generally south-east course for 50 miles to Santa Rosa valley, but then, turning away from this flat and uninterrupted alluvial plain which opens directly to San Francisco bay, flows westward through 20 miles of rugged cañon, winding through a highland 800 to 1200 feet in elevation. Possible explanations of this abrupt change of course are: (1) capture of the upper Russian river by the headward erosion of some short coast stream; (2) antecedence of the transverse portion of the valley to, and persistence through, the uplift which made the highland; (3) development of the drainage system on an uplifted surface of recent soft deposits, which have since been removed, leaving the Russian river in much of its course superimposed unconformably upon the "resurrected" topography; (4) the return of parts of the river to the original channel, making what has been termed a "resurrected" river. Mr. Holway discusses the general features of the coast ranges and their complicated history from the probable peneplanation in geologically recent times, through periods of subsequent elevation, renewed erosion, and depression, by which two very different classes of streams would be evolved according as the early erosion had or had not produced a mature topography before the succeeding elevation. It is important to decide for any stream what part of its course is *consequent* upon the last great uplift, and what is the more complex history of other portions. This Mr. Holway does in detail for the Russian river, discussing in turn its upper, middle, and lower sections. The conclusions arrived at are: that the lower river is antecedent, and to be considered as the remnant of a former consequent coast stream which has held its position despite the slow uplift; that the middle river in various characteristics gives evidence of being a superimposed river; and that the upper river has the marks of the typical subsequent river—an original tributary developed along a line of weakness until entitled to rank as part of the trunk of the main river.

AUSTRALASIA AND PACIFIC ISLANDS.

Baudin's Voyage to Australia.—The French voyage of exploration to Australia under Baudin in 1800–04 has often been regarded as owing its inception to political aims on the part of the first Napoleon, who has been credited with a desire to secure a part of the Australian continent for France.

In his book 'Terre Napoléon,' published in 1910, Mr. Ernest Scott combated this view, maintaining that no evidence of any aggressive intentions on the part of the promoters was to be found. Mr. Scott has since continued his researches, and has recorded the results (which appear to bear out his contention) in the *English Historical Review* for April, 1913. He has found, in the French archives, not only the Minister of Marine's instructions to Baudin, but the plan for the voyage prepared by the Institute, details of the equipment of the vessels, and reports sent home during the course of the voyage. The papers relating to the origin of the voyage certainly seem to show that its main purpose was that of geographical and scientific research. The sphere of action was chosen with a view to the improvement of knowledge of the little-known southern, western, and northern coasts of Australia; the eastern, where the English were already engaged in colonizing schemes, being excluded from the prescribed itinerary. Mr. Scott thinks that the Institute's plan for the voyage was the work of the same hand as the instructions prepared for the voyages of La Pérouse and D'Entrecasteaux, viz. the Comte de Fleurieu. The absence of aggressive aims is brought out in the letter from the Minister of Marine to Baudin, in which we read: "... tous vos travaux n'ayant pour objet que le perfectionnement des sciences, vous devez observer la plus parfaite neutralité, ne faire naître aucun doute sur votre exactitude à vous renfermer dans l'objet de votre mission," and so forth. That some material advantage to France was expected from the voyage, in the direction of trade development in the southern hemisphere, is certainly to be gathered from the documents printed, and the Institute's memorandum refers to the exploration as likely to be "très interessante pour les sciences ainsi que pour la politique. Il importe à la France de bien connoître les deux détroits qui séparent la Nouvelle Hollande de la terre de Diemen au sud et de la Nouvelle Guinée au nord." Mr. Scott hardly, perhaps, gives due weight to such hints of ulterior motives to be read into certain of the documents, though it is true that there is nowhere any implication of definite territorial aims.

Rumoured Disappearance of Islands in the Pacific.—The report brought to San Francisco early in September by Captain Trask, of the s.s. *Sonoma*, from Sydney, that Falcon and Hope islands, of the Tonga group, had entirely disappeared, with a large number of natives and some whites, must evidently be received with caution, as has been pointed out in the *Times* by Mr. Basil H. Thomson, our best authority on the Tonga islands, of which he was formerly "prime minister" under the native *régime*. That a volcanic disturbance has taken place, involving some loss of life, is quite possible, in view of past events of the kind in this region; but that the report is at least exaggerated is indicated, firstly by the fact that Falcon island, which first emerged from the sea in 1885, had for some time almost ceased to exist as anything but a reef, and was quite uninhabited; and secondly by the many previous reports of the destruction of Hope island (Niuafu of the natives) on the occasion of previous volcanic disturbances, all of which reports have proved unfounded. It is a well-peopled and thriving island, 500 feet above the sea at its highest point, and is noted for the fertility of its black volcanic soil. Mr. Thomson was at Tonga in 1886, one of the occasions on which the island was reported as destroyed, and went in charge of a relief expedition to feed the survivors from the supposed catastrophe. He found the island much as usual, apart from a thick coating of volcanic dust, which had been ejected from a newly-formed crater, the explosion being due to the penetration of the waters of a lake, which had taken the place of the old crater. Falcon island, on the other hand, was,

until 1885, merely a dangerous coral reef, awash at low water. It then broke into eruption, and formed a mass of pumice 100 feet high, which soon, however, began to melt away under the action of the waves. It was examined by H.M.S. *Egeria* in 1889, as is described by Mr. J. J. Lister in the *R.G.S. Proceedings* for 1890 (pp. 157–160, with illustrations). Little of it was left when seen by Mr. Thomson in 1891, but on a further visit in 1900, in H.M.S. *Porpoise*, indications were thought by the navigating lieutenant to exist that it was again beginning to emerge from the sea. Even then its highest point—apparently a hump of black lava—reached a height of only 9 feet.

POLAR REGIONS.

The Schröder-Stranz Expedition.—On August 17 the *Herzog Ernst* returned to Tromsö, having on board the members of the search expeditions under Herr Lerner and Captain Staxrud, as well as the last of the survivors of Lieut. Schröder-Stranz's original party. Although all hope of the safety of the leader and those with him after his separation from the rest of the expedition must now be abandoned, and there is little chance of the exact circumstances of their melancholy fate being ever made known, some additional details of the general course of the expedition and the experiences of some of its members are now available through the publication of reports by Herr Rave, quoted in the September number of *Petermanns Mitteilungen*. The *Herzog Ernst* reached the North cape of Spitsbergen on August 15, 1912, and about the same time the leader and three companions left the ship in sledges, intending to make the coast of North-East Land and cross the inland ice to Treurenburg bay. The ship reached that bay on August 22, and was soon afterwards caught in the ice. Finding it impossible to get free, the crew, with the exception of three Norwegian sailors, started on September 21 for Wijde bay, hoping to make their way overland to Advent bay. On October 1 two of their number, Dr. Moeser and Dr. Detmers, went on ahead, and were never seen again, the presumption being that they met with disaster in Wijde bay. On October 3 one of Dr. Rüdiger's feet was frost-bitten, and he remained behind with Rave in a hut on the east side of Wijde bay, both afterwards making their way back to the ship under great hardships. Captain Ritscher was delayed for some time at Cape Petermann, and only reached Advent bay on December 27, his two Norwegian companions having returned to the ship, while Herr Eberhardt became separated from them, and was lost. In January the first (unsuccessful) relief-expedition set out from Advent bay, and in February and March Dr. K. Wegener (of the German scientific station in Spitsbergen) carried out a search from Cross bay to Wijde bay.* Towards the end of March the Norwegian crew travelled overland from Treurenburg bay to Advent bay, leaving behind only Rüdiger and Rave. In April Captain Staxrud reached Treurenburg bay, escorting them to Advent bay across the inland ice in May. Meanwhile Herr Lerner also reached Treurenburg bay in the whaler *Lövenskjöld*, and went on to North-East Land, reaching North cape on May 5. A sledge trip along the north coast of this land brought to light no trace of Schröder-Stranz and his companions, who are therefore supposed to have met with disaster on their way to the land over the ice. In June the *Lövenskjöld* was lost at North cape, and Lerner returned by boat to Treurenburg bay, whither Staxrud had also returned. The *Herzog Ernst* was once more

* An account of the work of the station and of the above-mentioned search expedition appears in the same number of *Petermanns Mitteilungen*, with map.

made seaworthy and was navigated round the north coast to Ice fiord, after an unsuccessful attempt to push through Hinlopen strait. Thus ended one of the most disastrous expeditions in the history of Arctic enterprise, eight out of fifteen members having perished, while two returned home in a crippled condition. Staxrud remained in Spitsbergen to carry out such part of his original programme—the survey of the region between the north coast and Ice fiord—as might be possible in the time remaining. The geologist, Dr. Hoel (cf. *Journal*, vol. 41, p. 592), has also been at work between Ice fiord and Bell sound.

The Mawson Relief Expedition.—It is announced that a grant of £5000 in aid of the funds of this expedition (cf. *Journal*, August, p. 202) has been made by the Australian Government, bringing its total contribution to the undertaking up to £10,000. This will do much to relieve any anxiety felt by the explorer's friends on the score of the insufficiency of the funds.

MATHEMATICAL AND PHYSICAL GEOGRAPHY.

The Origin of Loess.—The question of the origin and mode of accumulation of loess has been once more brought into prominence through a study by the Russian geologist Obrucheff, published in 1911 at Tomsk, in which the traveller has brought to bear on it his unrivalled personal knowledge of the central regions of Asia, supplemented by a study of the writings of other experts. In view of its comparative inaccessibility to students by its issue in the Russian language, Prof. Merzbacher has done a valuable service by supplying a detailed analysis of the most important parts of the memoir, with critical remarks based on his personal investigations, in the first three numbers of *Petermanns Mitteilungen* for the present year. Of late the more or less generally accepted view of the æolian origin of loess has been called in question in Russia, notably by the geologists Armachevsky and Pavlof; and it is as a champion of the older view, though with some modifications of it as held by Richthofen, that Obrucheff has now come forward. While Armachevsky has rejected Richthofen's theory entirely, defining loess and other fine deposits as sub-aërial-alluvial sediments (in contradistinction from sub-aqual-alluvial deposits), Pavlof allows the possibility of an original sub-aërial formation, but holds that, in its present form, loess must be ascribed to transport by rain and melting snow, as well as occasional flood water issuing from the margins of mountain ranges. For the deposits formed (in his view) through these agencies he adopts the general name *proluvium*. While admitting that deposits of this class are frequently associated with loess under certain conditions, Obrucheff holds that the typical massive loess, showing but faint traces of stratification, can only be due to transport by the wind of the finer products of denudation in deserts or regions with sparse vegetation cover; laying special stress on the grading of the material by the wind and the indefinitely great distances to which the finer particles can be carried. Allowing due weight to this, he thinks that two assumptions made by Richthofen are incorrect or unnecessary, viz. (1) that loess is formed locally as an æolian deposit in basins without outlet; (2) that a series of physical and climatic changes has taken place in the past in the loess regions of Northern China now drained to the sea. Obrucheff holds that massive loess is being formed at the present day in these regions, and that the conditions of its formation in the past may have been quite similar to those now prevailing. By a study of the distribution of the typical loess in inner Asia he finds this quite consistent with the idea of a wind deposit laid down on the periphery of the deserts from which it originated—a gradation outwards from coarser to finer material being clearly traceable. He thinks that the water-transport

theory fails to account satisfactorily for the occurrence of loess in the varied positions in which it is found, and that there is no proof of the great changes of surface (degradation of former elevated areas, etc.) which must be presupposed by its exponents. While generally concurring in Obrucheff's views, Prof. Merzbacher thinks that he has to some extent misread Richthofen, and that the supposed differences between the two investigators are not so important as would appear from Obrucheff's memoir.

The Land and Water Hemispheres.—Following a method indicated by the late Prof. Krümmel, Dr. Beythien in 1898 attempted a more precise determination than had previously been made of the pole of the land hemisphere, which he placed on the French coast just outside the mouth of the Loire (*Journal*, vol. 13, p. 543). A new attempt, by direct construction on a globe-map, has lately been made by M. Alphonse Berget, who communicates the results in brief to the *Comptes Rendus* of the Paris Academy of Sciences (June 2, 1913). With a copper arc giving exactly a quadrant of the globe, he traced on it the great circle having as centre the point provisionally taken as the pole of the land hemisphere, making various experiments so as to obtain the most suitable point for this purpose. This proved to be Dumet island, off the mouth of the Vilaine, in 47° 24′ 42″ N. lat., 2° 37′ 13″ W. of Greenwich. He afterwards transferred to maps on equal-area projections the points of intersection of the different meridians by the great circle obtained, and thus marked off the portions of land left outside the land hemisphere. To estimate the total area of these detached portions he transferred their contours to an even sheet of thin brass, then cutting them out and weighing them accurately; also weighing a square of the same brass representing 1,000,000 square kilometres. The proportion of land and water in the two hemispheres was thus found to be as follows:—

Continental hemisphere	water	139,646,839	sq. kil. or 54·5	per cent.
	land	115,403,561	,, ,, 45·5	,, ,,
Oceanic hemisphere	water	226,335,111	,, ,, 88·7	,, ,,
	land	28,715,289	,, ,, 11·3	,, ,,

GENERAL.

Famous Early Maps as Transparencies.—The American Geographical Society has lately provided visitors to its building with an instructive object-lesson in the history of cartography, by placing as transparencies in the lecture-hall windows a series of forty-one maps selected as typical of the advance of map-making through the centuries. The work appears to have been carried out under the direction of Prof. E. L. Stevenson, whose previous contributions to our knowledge of early cartography are well known, and who has written a series of descriptive notes to explain the exhibit. The selection has been made with judgment, and few of the great monuments of past cartographical effort appear to be missing. Starting from the old Roman road map known as the Peutinger Tafel, the series takes us, through mediæval productions like the Beatus and Hereford maps, and the Portolan maps of the Mediterranean nautical peoples, to the wider horizons of the maps showing the great discoveries of the fifteenth and sixteenth centuries. Some of the reproductions are supplied for the first time. We find, *e.g.*, one of the maps by Glareanus from the manuscript lately in the possession of Major-General E. R. James (cf. the article on Glareanus and his maps in the *Journal* for June, 1905) and a world-map by Ortelius of 1564, or six years previous to the publication of the first edition of the famous atlas. The only known original copy of this last is in the University

Library at Basel, and the map is far less known to students than other productions of the same school, *e.g.* Mercator's great planisphere of 1569. The transparencies are as nearly uniform in dimensions as the peculiarities of the original maps permit, and in most cases are arranged in chronological order, as is also the case with the descriptive notes. The proper placing in the series of the fifteenth-century reproduction of Ptolemy's map was no doubt a difficulty. It has been placed among maps of that period (coming next to that of Fra Mauro), which some may think a mistake, as the geography represented is, of course, that of the second century. The handbook also describes other maps, of which framed reproductions are hung on the walls, and will serve a useful purpose (apart from its immediate object) in pointing out what are the really important landmarks in cartographical progress.

GEOGRAPHICAL LITERATURE OF THE MONTH.

Additions to the Library.

By EDWARD HEAWOOD, M.A., *Librarian*, R.G.S.

The following abbreviations of nouns and the adjectives derived from them are employed to indicate the source of articles from other publications. Geographical names are in each case written in full:—

A. = Academy, Academie, Akademie.
Abh. = Abhandlungen.
Ann. = Annals, Annales, Annalen.
B. = Bulletin, Bollettino, Boletim.
Col. = Colonies.
Com. = Commerce.
C.R. = Comptes Rendus.
E. = Erdkunde.
G. = Geography, Géographie, Geografia.
Ges. = Gesellschaft.
I. = Institute, Institution.
Iz. = Izvestiya.
J. = Journal.
Jb. = Jahrbuch.
Jber. = Jahresbericht.
k.k. = kaiserlich und königlich.
M. = Mitteilungen.
Mag. = Magazine.
Mem. (Mém.) = Memoirs, Mémoires.
Met. (mét.) = Meteorological.
P. = Proceedings.
R. = Royal.
Rev. = (Riv.) = Review, Revue, Rivista.
S. = Society, Société, Selskab.
Sc. = Science(s).
Sitzb. = Sitzungsbericht.
T. = Transactions.
Ts. = Tijdschrift, Tidskrift.
V. = Verein.
Verh. = Verhandlungen.
W. = Wissenschaft, and compounds.
Z. = Zeitschrift.
Zap. = Zapiski.

On account of the ambiguity of the words *octavo*, *quarto*, etc., the size of books in the list below is denoted by the length and breadth of the cover in inches to the nearest half-inch. The size of the *Journal* is 10 × 6½.

A selection of the works in this list will be noticed elsewhere in the "Journal."

EUROPE.

Austria—Dalmatia. **Hartleben.**

Illustrated Guide Hartleben No. 65. Handbook of Dalmatia, Abbazia, Lussin, etc.; "The Austrian Riviera," including the Albanian Coast, the Ionian Islands, Corfu, Patras, Athens. Vienna, etc.: A. Hartleben, 1913. Size 6½ × 4, pp. xvi. and 192. *Maps, Plans, and Illustrations. Price 6s. net. Presented by the Publisher.*

A useful guide to one of the less-visited regions of Europe, very fully illustrated, and supplemented by a compact vocabulary.

Austria—Geology. **Schaffer.**

Sammlung geologischer Führer, 18. Geologischer Führer für Exkursionen im Wiener Becken. 3. Teil. Von Dr. Franz X. Schaffer. Berlin: Gebr. Borntraeger, 1913. Size 6½ × 4, pp. x. and 167. *Map and Illustrations. Price M.5.40.*

One of an excellent series, useful both to the geologist and geographer.

Central Europe—Jura. **Schlee.**

Zur Morphologie des Berner Jura. Von Prof. Dr. P. Schlee. (Sonderabdruck aus Mitteilungen der Geographischen Gesellschaft in Hamburg, Bd. 27.) Hamburg: L. Friederichsen & Co., 1913. Size 9 × 6½, pp. 42. *Sketch-maps, Sections, and Illustrations. Price M.3. Presented by the Publishers.*

Denmark—Fisheries. **Johansen.**

Om Rødspætten og Rødspættefiskeriet i Beltfarvandet med nogle Bemærkninger om de Øvrige Flynderarter og Flynderfiskerier i Samme Farvand. Af Dr. A. C. Johansen. (Skrifter udgivne af Kommissionen for Havundersøgelser, No. 7.) Copenhagen: C. A. Reitzel, 1912. Size 10 × 7, pp. 158. *Maps and Plates.*

Denmark—Great Belt. **Otterstrøm.**

Sildens Afhaengighed af forskellige Hydrografiske og Meteorologiske Forhold i Store Bælt. Af Andreas Otterstrøm. (Skrifter udgivne af Kommissionen for Havundersøgelser, No. 6.) Copenhagen: C. A. Reitzel, 1910. Size 10 × 7, pp. 51. *Illustrations.*

Europe. **Marsh.**

The Rambler Travel Books: the countries of the world as described in works of travel. Europe. Edited by Lewis Marsh. London: Blackie & Son, 1913. Size 7½ × 5½, pp. 80. *Illustrations. Price 9d. Presented by the Publishers.*

Europe, South-East—Archæology. **Minns.**

Scythians and Greeks: a survey of ancient history and archæology on the north coast of the Euxine, from the Danube to the Caucasus. By Ellis H. Minns. Cambridge: University Press, 1913. Size 12 × 9½, pp. xl. and 720. *Maps and Illustrations. Price £3 3s. Presented by the Publishers.*

France—Dauphiné. *La G., B.S.G. Paris* **27** (1913): 203–207. **Girardin.**

Les formations fluvio-glaciaires du bas Dauphiné. Par Paul Girardin. *Illustration.*

France—Dauphiné. **Vaughan.**

Campaigns in the Dauphiny Alps, 1588-1747. By Miss D. M. Vaughan. (Extract from the *English Historical Review*, vol. 27, April, 1913.) London, 1913. Size 10 × 6½, pp. 228–242. *Sketch-maps.*

France—Gard. *La G., B.S.G. Paris* **27** (1913): 197–202. **Lemoine.**

Les régions naturelles du département du Gard. Par Paul Lemoine. *Illustration.*

France—Historical. *B.G. Historique et Descriptive*, 1912: 268–273. **Prentout.**

Les limites de la Bretagne et de la Normandie au X^e^ siècle. La bataille de Caen. Par Henri Prentout.

France—Place-names. *B.G. Historique et Descriptive*, 1912: 56–74. **Soyer.**

Recherches sur les noms propres géographiques d'origine celtique dans l'Orléanais. Par Jacques Soyer.

France—Seine. **Thorpe.**

The Seine from Havre to Paris. By Sir Edward Thorpe. London: Macmillan & Co., 1913. Size 9 × 5½, pp. xxi. and 493. *Maps and Illustrations. Price 12s. 6d. net. Presented by the Publishers.*

Based on experiences during yachting voyages, especially one carried out in 1912. Besides treating of the river both in its physical characters and as a waterway, the book, which is excellently illustrated in the drawings by Olive Branson, gives pleasant accounts of the places visited and their associations.

France—South-East—Hydrology. **Ministère de l'Agriculture.**

Ministère de l'Agriculture; Direction Générale des Eaux et Forêts. Service des grandes forces hydrauliques dans la région des Alpes; Tomes 5 et, Résultats des études et travaux à la fin de 1911. [Paris], 1912–13. Size 11 × 7, pp. 530, 494. *Illustrations and Diagram.* The same. Annexe du Tome 6, Nivellements. (*Case of Maps, Profiles, etc.*)

Franco-Spanish Boundary. *B.G. Historique et Descriptive*, 1912: 217–245. **Saint-Saud.**

Questions de Frontière Franco-Espagnole, par A. de Saint-Saud. Notes sur la commission internationale de délimitation de 1784–1792.

Germany. *Verh.* **18.** *Deutschen Geographentages Innsbruck*, 1912: 91–99. **Hahn.**

Bericht der Zentralkommission für wissenschaftliche Landeskunde von Deutschland 1909–1912. Von Dr. F. G. Hahn.

Germany—Air-temperature. **Henze.**
Veröffentlichungen K. Preussischen Met. I., Abh. **4** (1912), No. 7: pp. 49.
Der tägliche Gang der Luftemperatur in Deutschland. Von H. Henze. *Sketch-map.*

Germany—Alsace. *Ann. de G.* **22** (1913): 94–98. **Auerbach.**
L'industrie du coton en Alsace. Les conditions géographiques d'une grande industrie. Par B. Auerbach.

Germany—Baden. **Geological Survey of Baden.**
Geologische Spezialkarte des Grossherzogtums Baden. Erläuterungen zu Blatt Stühlingen (Nr. 144), von F. Schalch. Herausgegeben von der Grossherzoglich Badischen Geologischen Landesanstalt, in Verbindung mit der Schweizerischen Geologischen Kommission. Heidelberg, 1912. Size 9 × 6, pp. 92.

Germany—Bavaria. *Petermanns M.* **59** (1913): I. 237–242. **Rothpletz.**
Die Strudellöcher im Münchner Deckenschotter. Von Prof. Dr. August Rothpletz. *Illustrations.*

Germany—Black Forest. *M. Ges. München* **7** (1912): 133–137. **Levy.**
Das System des Feldberggletschers im hohen Schwarzwald. Von Friedrich Levy.
A study in diluvial glaciation.

Germany—Climate. *Petermanns M.* **59** (1913): I. 232–237. **Knörzer.**
Temperaturanomalien und Luftdruckverteilung im Hochsommer und Frühherbst 1911 und 1912. Von Albert Knörzer. *Sketch-maps.*

Germany—Climate. *Beiträge Geophysik* **12** (1912): 13–44. **Richter.**
Die geographische Verteilung der Eis-, Frost-, und Hitzetage im Deutschen Reiche. Von Wilhelm Richter. *Maps.*

Germany—Coast. **Spethmann.**
Meer und Küste von Rügen bis Alsen. Von Hans Spethmann. (From *Meereskunde* **6** (1912): pp. 1–41.) *Map and Illustrations.*

Germany—Geomorphology. *Beiträge Geophysik* **12** (1912): 89–163. **Arldt.**
Parallelismus der Leitlinien Deutschlands. Von Dr. Th. Arldt. *Sketch-maps.*

Germany—Glaciation. **Stamm.**
Verh. Naturhistorischen Vereins preussischen Rheinland und Westfalens, 1912 (1913): 151–213.
Glacialspuren im Rheinischen Schiefergebirge. Von Kurt Stamm. *Map and Illustrations.*

Germany—Harz. **Damköhler.**
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Grundriss einer Grammatik des Kimatumbi. (Deutsch-Ostafrika, Bezirk-Kilwa.) Von Bernard Krumm.

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Société de l'Histoire des Colonies Françaises. Premier voyage du Sieur de La Courbe fait à la coste d'Afrique en 1685. Publié...par P. Cultru. Paris: E. Champion, 1913. Size 9½ × 6, pp. lviii. and 321. *Facsimile map. Purchased.*

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The history of Lost River. By Robert W. Sayles.

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The reforestation of cut over and idle lands in New York. (Reprinted from *Bulletin* of New York State College of Forestry at Syracuse University, Series xiii., February, 1913.) Syracuse, N.Y., 1913. Size 8½ × 5½, pp. 16. *Illustrations.*

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The Snowfall of the United States. By Charles F. Brooks. *Map.*

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United States Geological Survey. Thirty-third Annual Report of the Director of the United States Geological Survey to the Secretary of the Interior for the fiscal year ended June 30, 1912. Washington, 1912. Size 9 × 6, pp. 176. *Sketch-maps.*

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On the changes of the boundary necessitated by the wandering of the Rio Grande

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Bolivia. **Herzog.**

Vom Urwald zu den Gletschern der Kordillere: zwei Forschungsreisen in Bolivia. Von Dr. Theodor Herzog. Stutgart: Strecker & Schröder, 1913. Size 9½ × 7, pp. xi. and 270. *Maps and Illustrations. Price* 11*s.*

Scientific researches in one of the least-known parts of Bolivia.

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The British Guiana Handbook, 1913; containing general and statistical information concerning the colony, its industries, manufactures, and commerce. Edited by Alleyne Leechman, and issued by the Permanent Exhibitions Committee. Georgetown, 1913. Size 8½ × 5½, pp. x. and 286. *Illustrations. Price* 2*s. Presented by the Committee.*

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Panama Canal. **Barrett.**

Panama Canal: what it is; what it means. By John Barrett. Washington, D.C.: Pan-American Union, 1913. Size 9 × 5½, pp. 120. *Maps and Illustrations. Presented by the Pan-American Union.*

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The Panama Canal: a history and description of the enterprise. By J. Saxon Mills. London: T. Nelson & Sons, 1913. Size 7½ × 5½, pp. 344. *Maps and Illustrations. Price* 2*s. net. Presented by the Publishers.*

A useful summary of information on the canal under its various aspects.

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Marianne Islands. **Prowazek.**

Die Deutschen Marianen: ihre Natur und Geschichte. Von S. von Prowazek. Leipzig: J. A. Barth, 1913. Size 8½ × 5½, pp. 127. *Sketch-maps and Illustrations. Price M.4. Presented by the Publisher.*

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Report on the geology of the Northern Territory. By Dr. W. G. Woolnough. *Map, Illustrations, and Sections.*

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Report on the results of a census of the Dominion of New Zealand, taken for the night of the 2nd April, 1911. By M. Fraser, Government Statistician. Wellington, N.Z., 1913. Size 11 × 8½, pp. viii. and 178.

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Some less-known islands in the Pacific. By Sir Everard im Thurn.

Pacific Ocean. *Rept. Australasian Ass.* 13, 1911 (1912): 90–99. **Marshall.**

Section C., Geology. Address by the President, Prof. P. Marshall [on the true structural boundary of the Pacific Ocean Basin]. *Sketch-map.*

Pitcairn Island—Historical. **Macdonald.**

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Discovery of Pitcairn Island—Mutiny of the *Bounty*—Life of the mutineers on Pitcairn and their removal to Norfolk Island. By A. C. Macdonald.

South Australia—Glacial Epoch. **Howchin.**

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Cambrian and Permo-carboniferous glaciation. By W. Howchin.

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The Heemskirk Massif: its structure and relationships. By L. Keith Ward. *Maps.*

Victoria—Bourke. *P.R.S. Victoria* 25 (1913): 268–285. **Hart.**

On the country between Melbourne and the Dandenong Creek. By T. S. Hart.

Western Australia—Geology. **Maitland and Montgomery.**

Western Australia, Geol. Survey B., No. 50 (1912): pp. 68.

The geology and mineral industry of Western Australia. By A. Gibb Maitland and A. Montgomery. *Map and Illustrations.*

POLAR REGIONS.

Antarctic—Meteorology. **Hepworth.**

National Antarctic Expedition, 1901–1904. Meteorology; Part 2, comprising daily synchronous charts, October 1, 1901, to March 31, 1904. Prepared in the Meteorological Office under the superintendence of Commr. M. W. Campbell Hepworth. London: Royal Society, 1913. Size 19½ × 9, pp. 26. *Maps. Presented by the National Antarctic Expedition.*

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Navigation. **Hall.**

Appendix to Raper's Practice of Navigation, being an Explanation of the New Astronomical Navigation by the method of calculated Zenith distances, with special tables for simplifying and shortening the work. By William Hall, R.N. London: J. D. Potter, 1913. Size 10 × 6½, pp. 41.

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Ueber die Anwendung des Stereoautographischen Verfahrens für Mappierungszwecke. Von Eduard Ritter von Orel. *Maps and Illustration.*

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Orientierung in der Nähe der Erdpole. Kritische Beantwortung der Frage: Ist es überhaupt möglich zu entscheiden, ob ein Polarforscher sich am Pole befand? Von C. Schoy. *Diagram.*

PHYSICAL AND BIOLOGICAL GEOGRAPHY.

Meteorology. *Met. Z.* **30** (1913): 49–58. **Braak.**
Ueber die Ursache langperiodischer Barometer- und Temperaturschwankungen. Von Dr. C. Braak.

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Die Veränderungen in der allgemeinen Zirkulation der Atmosphäre in den gemässigten Breiten der Erde. Von Dr. A. Defant.

Meteorology—Evaporation. **Halbfass.**
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Neuere Versuche, die Verdunstung von Wasserflächen zu messen, insbesondere von Seen. Von Prof. Dr. W. Halbfass. *Illustrations.*

Meteorology—Föhn. **Ficker.**
Sitzb. K.A.W. Wien **121** (1912): Abt. IIa., 1225–1243.
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Meteorology—Observatory. [Hellmann.]
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Meteorology—Pressure. *Met. Z.* **30** (1913): 121–125. **Köppen.**
Zusammenhang der Luftdruckabweichungen über Island, den Azoren und Europa. Von W. Köppen. *Chart.*

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Sky radiation and the isothermal layer. By Frank W. Very. *Diagrams.*

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Das Verhältnis des Waldes und des Gebirges zur Erhaltung des Schnees. Von Dr. J. E. Church. *Illustrations.*

Meteorology—Upper air. *Met. Z.* 1912: 305–308. **Van Bemmelen.**
Die Temperatur des tropischen Luftmeeres nach Beobachtungen mittels Registrierballons in Batavia. Von W. van Bemmelen.

Oceanography. **McEwen.**
Internationale Rev. Hydrobiologie und Hydrographie **5** (1912): 242–286.
The Distribution of Ocean Temperatures along the West Coast of North America deduced from Ekman's Theory of the Upwelling of Cold Water from the Adjacent Ocean Depths. By Dr. George F. McEwen. *Illustrations.*
See note in the August number.

Oceanography—Adriatic. *M. k.k. G. Ges Wien* **55** (1912): 639–649. **Grund.**
Die sechste Terminfahrt S.M.S. *Najade* in der Hochsee der Adria von 17. Mai bis 13. Juni 1912. Vorläufiger Bericht . . . von Prof. Dr. Alfred Grund.

Oceanography—Atlantic. **Merz.**
Verh. 18. *Deutschen Geographentages Innsbruck*, 1912: 82–90.
Eine ozeanographische Forschungsreise im Atlantischen Ozean 1911. Von Dr. Alfred Merz.

Oceanography—Atlantic. **Lohmann.**
Internationale Rev. Hydrobiologie u. Hydrographie **5** (1912): 185–225, 343–372.
Beiträge zur Characterisierung des Tier- und Pflanzenlebens in den von der *Deutschland* während ihrer Fahrt nach Buenos Ayres durchfahrenen Gebieten des Atlantischen Ozeans. Von H. Lohmann. *Illustrations.*

Oceanography—Baltic. **Witting.**
Beobachtungen von Temperatur und Salzgehalt an festen Stationen in den

Jahren 1900–1910. Von Dr. Rolf Witting. (Finländische Hydrographisch-Biologische Untersuchungen, No. 8.) Helsingfors, 1912. Size 12½ × 9½, pp. 78.

Oceanography—Baltic. **Witting.**

Beobachtungen von Oberflächenstrom, Tiefenstrom, und Wind, an Feuerschiffen in den Jahren 1900–1910. Von Dr. Rolf Witting. (Finländische Hydrographisch-Biologische Untersuchungen, No. 9.) Helsingfors, 1912. Size 12½ × 9½, pp. 99.

Oceanography—Berlin Institute. *M. k.k. G. Ges. Wien* **55** (1912): 413–433. **Penck.**

Das Museum und Institut für Meereskunde in Berlin. Von Prof. Dr. Albrecht Penck. *Illustrations.*

Oceanography—Currents. *J.G. Tōkyō G.S.* **24** (1912): 713–726. **Fuzimori.**

Oceanic currents in the vicinity of the Bonin Islands. By S. Fuzimori. [In Japanese.]

Oceanography—Depths. *Petermanns M.* **59** (1913) I.: 250–251. **Groll.**

Die Lotungsdichtekarten von J. Thoulet. Von Dr. Max Groll. *Map.*

Oceanography—Tides. **Sterneck.**

Sitzb. K.A.W. Wien **121** (1912): Abt. IIa., 1245–1288.

Das Gezitenphänomen im westlichen Mittelmeer. Von Dr. Robert v. Sterneck.

Zoogeography. **Newbigin.**

The Oxford Geographies; edited by Dr. A. J. Herbertson. Animal geography: the faunas of the natural regions of the globe. By Dr. Marion I. Newbigin. Oxford: Clarendon Press, 1913. Size 7½ × 5, pp. 238. *Illustrations. Price* 4*s.* 6*d. Presented by the Publishers.*

ANTHROPOGEOGRAPHY AND HISTORICAL GEOGRAPHY.

Commercial—Communications. **Hassert.**

Allgemeine Verkehrsgeographie. Von Dr. Kurt Hassert. Berlin: G. P. Göschen, 1913. Size 9½ × 6, pp. viii. and 494. *Maps and Diagrams. Price M.*10. *Presented by the Publisher.*

Historical—Voyages. **Scott.**

Baudin's voyage of exploration to Australia. By Ernest Scott. (Extract from the *English Historical Review*, vol. **28**, April, 1913.) London, 1913. Size 10 × 6½, pp. 341–346.

See note in the Monthly Record, *ante*, p. 400.

History of Cartography. **Stevenson.**

Maps reproduced as glass transparencies, selected to represent the development of map-making from the First to the Seventeenth Century. By Edward Luther Stevenson. New York, 1913. Size 7½ × 5, pp. 46. *Facsimile Maps.*

See note in the Monthly Record, *ante*, p. 404.

History of Cartography. **Stevenson.**

Portolan Charts; their origin and characteristics, with a descriptive list of those belonging to the Hispanic Society of America. By Dr. Edward Luther Stevenson. New York, 1911. Size 10½ × 7, pp. viii. and 76. *Facsimile charts. Presented by the Author.*

See notice in vol. **41**, p. 62.

History of Navigation. **Bensaude.**

Joaquim Bensaude. L'astronomie nautique au Portugal à l'époque des grandes découvertes. [1re partie.] Bern: M. Drechsel, 1912. Size 10 × 7½, pp. 290. *Price* 12.50 *fr. Presented by the Author.*

GENERAL.

Alphabet. **Johnston.**

Phonetic spelling; a proposed universal alphabet for the rendering of English, French, German, and all other forms of speech. By Sir Harry Johnston. Cambridge: University Press, 1913. Size 7½ × 5, pp. vi. and 92. *Price* 3*s.* 6*d. net. Presented by the Publishers.*

Perhaps the most rational system yet suggested, with due regard to simplicity.

Bibliography—Periodicals. **Royal Society.**

Catalogue of the periodical publications in the Library of the Royal Society of

London. London: H. Froude, 1912. Size 10½ × 7½, pp. viii. and 455. *Presented by the Royal Society.*

Education—Text-books. **Frew.**

Blackie's elementary regional and practical geographies. By David Frew. General survey of the world (pp. 80); Asia (pp. 80); Africa and Australia (pp. 80); North, Central, and South America (pp. 80). London: Blackie & Son, 1913. Size 7½ × 5. *Sketch-maps and Diagrams. Price (each) 6d. Presented by the Publishers.*

Geography. **Czirbusz.**

A nemzeti müvelödés geografiája és a geografiai fatalisták. Irta: Dr. Czirbusz Geza. [The geography of national culture and the geographical fatalists. By Dr. Géza Czirbusz.] Budapest: Bela Hoffman, 1912. Size 9 × 6, pp. xvi. and 383.

See Review in the July number, p. 72.

Text-book. **Franklin and Griffiths.**

The atlas geographies: a new visual atlas and geography combined. Part 1: Physical Geography. By Thomas Franklin and E. D. Griffiths. London: W. & A. K. Johnston, [1913]. Size 10 × 7½, viii. and 88. *Map and Diagrams. Price 1s. 6d. Presented by the Publishers.*

Year-book. **Chisholm.**

The Britannica Year-book, 1913; a survey of the world's progress since the completion in 1810 of the 'Encyclopædia Britannica,' 11th edit. . . . Edited by Hugh Chisholm. London: The Encyclopædia Britannica Co., 1913. Size 9 × 6, pp. xliv. and 1226. *Price 10s. Presented by the Publishers.*

An indispensable supplement to the 'Encyclopædia Britannica.'

NEW MAPS.

By E. A. REEVES, *Map Curator*, R.G.S.

EUROPE.

British Isles. **Gross.**

New Road Maps: 25 miles round London; Eastern Counties; Hampshire and Berkshire; Kent; Surrey and Sussex. By Alexander Gross. London: "Geographia," Ltd., [1913]. *Price, unmounted, 1d. each; mounted, 3d. each. Presented by the Publishers.*

British Isles—England and Wales. **Ordnance Survey.**

Sheets published by the Director-General of the Ordnance Survey, from August 1 to 31, 1913.

1-inch map.

England and Wales. Sheets 14, 22, revised, 2nd edition, engraved in outline. *Price 1s. 6d.*

6-inch maps.

Revised. Quarter-sheets, with contours in blue.

Berkshire, 36 N.W., 37 N.E. **Cheshire,** 7 N.W., 7 S.E., 13 N.E., 22 N.W. (30A N.E. and 30 N.W.), 38 N.W., 46 N.E., 46 S.E., 60 N.E., 60 S.W. **Lancashire,** 51 N.W., 51 N.E., 61 N.E. **Oxfordshire,** 58 N.E. **Sussex,** 4 N.E., 13 N.E., 64 S.W., 73 N.W. **Yorkshire,** 90 S.W., 124 N.E. *Price 1s. each.*

Kent, 7 S.E., with contours in black. *Price 1s.*

Berkshire, with contours in red, 15 S.E., 20 S.W., 26 S.W., 27 N.W., 28 S.W., 31 S.W. **Sussex,** 10 S.E., 11 N.W., 21 S.E., 22 N.E., 61 S.W., 74 N.E. **Yorkshire,** 50 S.W.

1 : 2500 scale.

Revised, with houses stippled, and with areas. *Price 3s. each.*

Denbighshire, 3–13, 14. **Lancashire,** 17–2, 3, 18–14, 25–1, 5, 13, 15, 26–6, 9, 31–3, 8, 32–3. Sheet 26–15. *Price 1s. 6d.* **Norfolk,** 64–2. **Shropshire,** 55–4, 8, 12. **Surrey,** 1–16. **Warwickshire,** 22–1, 2, 5, 6, 9, 10, 14. **Yorkshire,** 54–8, 12, 13, 14, 15, 55–11, 15, 56–6, 70–2, 3, 5, 16, 71–6, 10, 13.

There are no coloured editions of these sheets, and the unrevised impressions have been withdrawn from sale.

(*E. Stanford, Ltd., London Agents.*)

British Isles—London. **Philip.**

The Royal Automobile Club Official Large-Scale Route Map of Inner London. Scale 1: 31,680 or 2 inches to 1 stat. mile. London: George Philip & Son, Ltd., [1913]. *Price* 1*s.* 6*d.* *Presented by the Publishers.*

British Isles—London. **Railway Clearing House.**

Official Railway Map of London and its environs. Scale 1 : 31,680 or 2 inches to 1 stat. mile. 2 sheets. Prepared and published at the Railway Clearing House. London, 1913. *Price* 8*s.* 6*d.*

France. **Michelin.**

Carte Michelin: France en 47 Feuilles au 1 : 200,000 (1 inch to 3·2 stat. miles). Sheets: 27, Limoges; 34, Bordeaux; 35, Aurillac-Cahors; 38, Mont-de-Marsan; 39, Agen-Montauban. Paris: Ch. Delagrave, [1913]. *Price* 1 *fr. each sheet.*

Germany. **K. Sächs. Generalstab.**

Karte des Deutschen Reiches. Königreich Sachsen. Herausgegeben von der Abteilung für Landesaufnahme des Königl. Sächs. Generalstabes. Scale 1 : 100,000 or 1 inch to 1·6 stat. miles. Umdruckausgabe. Sheet 441, Altenburg. Dresden: G. A. Kaufmann, 1913. *Price* 50 *Pg. each sheet.*

Spain. **Mendez.**

Provincia de Madrid. Mapa construido con los datos del Instituto Geografico y Estadistico. Escala de 1 : 200,000 (1 inch to 3·2 stat. miles). Completado y publicado por Don Jose Mendez. Madrid, [1913].

A useful general map of the province of Madrid, based upon the large-scale government surveys. Relief is shown by brown contours at varying intervals, rivers blue, railways black, and roads red. In addition to the map itself there is a table of the *Ayuntamientos* giving population, area under cultivation, areas not cultivated, altitudes, and other particulars.

ASIA.

Central Asia. **Stein.**

Map of portions of Chinese Turkestan and Kansu to illustrate the explorations of Dr. (now Sir) M. A. Stein, C.I.E., and his assistants, Surveyors R. B. Lal Singh and R. S. Ram Singh, Survey of India, 1906–08. Scale 1 : 253,440 or 1 inch to 4 stat. miles. 94 sheets. Dehra Dun: Survey of India Office, 1911–13. *Presented by Sir Mark Aurel Stein,* K.C.I.E.

These ninety-four sheets embody the complete cartographical results of this important expedition, and in atlas form will accompany the detailed report which is soon to be published. Sir M. Aurel Stein gave a general account of this journey in his paper published in the *Geographical Journal* for July, 1909, and the maps which appeared in the number for March, 1911, were, in the main, reduced from incomplete preliminary editions of the above sheets, without hills, supplied by the Survey of India. These sheets have now been completed and heliozincographed at the Survey of India Offices, Dehra Dun. They are based principally upon the plane-tabling carried out by R. B. Lal Singh and R. S. Ram Singh, the two Indian surveyors who, accompanied Sir M. Aurel Stein, adjusted to latitudes, and azimuths determined by astronomical observation and supplemented by triangulation. It was not found possible to carry out any longitude observations, and in this respect the map depends upon the adjusted traverses only. Each sheet includes an area of one degree of latitude and longitude. An account of the surveys, and the method upon which they were carried out, is given by Sir M. Aurel Stein in the *Geographical Journal* for March, 1911, and a fuller description will be published in the official report soon to appear. The final computation of the results and the preparation of the sheets for publication, has necessarily entailed a vast amount of labour, and the Survey has spared no pains to make the map as complete as possible. At the bottom of each sheet is an explanation of the conventional signs used; triangulation stations, latitudes observed astronomically, stations where latitude and azimuth were observed, trigonometrical heights, and heights determined by barometer and by clinometer, are there all clearly indicated, together with particulars as to spelling of names, ancient rites, ways of communication, mines, and other information. The sheets are printed in colours, the hill work by brown vertical hachures in the style usual in the Survey of India Trans-frontier maps.

China. **China Inland Mission.**

A Map of China prepared for the China Inland Mission. Scale 1 : 3,000,000 or 1 inch to 47·3 stat. miles. Two sheets. London: China Inland Mission and Edward Stanford, Ltd., 1913.

A new edition of a useful general map of China, which first appeared two years ago.

The principal revision has taken place in the province of Sechuan, where the river-systems have been corrected from later information.

China. **K. Preuss. Landesaufnahme.**

Karte von Ost-China. Herausgegeben von der Kartographischen Abteilung der Königl. Preussischen Landesaufnahme. Scale 1 : 1,000,000 or 1 inch to 15·9 stat. miles. Sheet: Peking. Berlin: R. Eisenschmidt, 1912.

Since the publication of the 1909 edition of this sheet much additional geographical information has been obtained, specially in the north-western part of the area included, and this has been utilized in the revision.

AFRICA.

Africa. **Bartholomew.**

Political Map of Africa. By J. G. Bartholomew, LL.D., F.R.G.S. Edinburgh: John Bartholomew & Co., [1913]. *Price* 1*s.*

Egyptian Sudan. **Survey Office, Khartoum.**

Anglo-Egyptian Sudan. Scale 1 : 250,000 or 1 inch to 3·9 stat. miles. Sheets: 54–G, Um Badr; 55–I, El Obeid; 65–C, El Buta; 66–I, Lake No.; 66–O, Nasser. Khartoum: Survey Office, 1913. *Price* 10 *P.T. each sheet. Presented by the Director of Surveys, Sudan Government.*

North-East Africa. **Ministero degli Affari Esteri.**

Missione per la Frontiera Italo-Etiopica. Scale 1 : 500,000 or 1 inch to 7·9 stat. miles. Six sheets. Ditto: Dolo—Pozzi Uascen. Scale 1 : 100,000 or 1 inch to 1·6 stat. mile. Two sheets. 1911. Pianta di Addis Abbeba. Scale 1 : 25,000 or 2·5 inches to 1 stat. mile. Rome: Ministero degli Affari Esteri, Direzione Centrale degli Affari Coloniali, 1912. *Presented by the Direttore Centrale degli Affari Coloniali, Rome.*

The first of these maps is in six sheets, and includes the route of the mission from Harrar to Brava on the Indian ocean, *viâ* Addis Abeba, Goba, Dolo, and Lugh. No attempt has been made to indicate the actual frontier, and it is in fact a route survey adjusted to astronomically determined positions, which are indicated by a special symbol. There is a supplementary sheet containing a plan of Addis Abeba on the scale of 1 : 25,000.

The second map is in two sheets on the scale of 1 : 100,000, and includes the country through which the Mission passed for about 80 miles due east of Dolo.

Sahara. **Cortier and Malroux.**

Mission Cortier. Adrar des Ifoghas dressée par le Capitaine Cortier et l'Adjudant Malroux d'après les Itinéraires de M. le Colonel Laperrine, MM. les Capitaines Cortier, Dinaux, Niéger, Pasquier et Théveniaut, MM. les Lieutenants Clor. de Saint-Léger, Lenglumé, Sigonney et Vallier appuyés sur 30 positions astronomiques dont 25 de M. le Capitaine Cortier et 5 de M. Villatte, 1912. Scale 1 : 500,000 or 1 inch to 7·8 stat. miles. 2 sheets. Paris: Service Géographique des Colonies, 1912. *Price* 2 *fr. Presented by the Ministère des Colonies, Paris.*

The area included in this map lies between 18° and 21° N. lat. and 0° 30′ W. and 3° 20′ E. long. A list of the thirty astronomically determined positions to which the route survey has been adjusted is given in a table at the side.

South Africa. **Bartholomew.**

Bartholomew's Reduced Survey Map of South Africa, coloured to show height of land. Scale 1 : 2,500,000 or 1 inch to 39·4 stat. miles. Edinburgh: John Bartholomew & Co., [1913]. *Price* 2*s., unmounted. Presented by the Publishers.*

Union of South Africa. **Mines Department, Geological Survey.**

Geological map of the Union of South Africa. Scale 1 : 150,000 or 1 inch to 2·3 stat. miles. Sheet 11, Lydenburg. With explanation. Pretoria: Mines Department, Geological Survey, 1913. *Presented by the Mines Department, Geological Survey, Pretoria.*

West Africa. **Service Géographique des Colonies, Paris.**

Carte de la Guinée Française. Scale 1 : 500,000 or 1 inch to 7·8 stat. miles. Sheet 1. Timbo (2nd edit.). Paris: Service Géographique des Colonies, 1912. *Price* 3 *fr. Presented by the Ministère des Colonies, Paris.*

A comparison of this edition with that published in 1902 will show that a large amount of exploratory work has been done in the region during the interval. This is particularly noticeable near the Portuguese Guinea frontier, where many spaces that were left blank have now been filled in from route traverses.

AMERICA.

Honduras. **Fiallos.**

Honduras. Por E. C. Fiallos. Scale 1:800,000 or 1 inch to 12·6 stat. miles. [N.P.], 1909.

The cartographical material for the mapping of the republic of Honduras is so meagre and scanty that any new map of the country that adds to our information is welcome, although it may be but rough and approximate. This map fills in several blank spaces shown on those previously published, and in addition gives a useful table of the departments, capitals of each, number of districts, areas, population, and number of inhabitants to the square kilometre.

GENERAL.

World. **Service Géographique des Colonies, Paris.**

Planisphère montrant la Répartition du globe terrestre entre les 24 fuseaux horaires. Equatorial scale 1:100,000,000 or 1 inch to 1578 stat. miles. Paris: Service Géographique des Colonies, [1913]. *Price* 0·75 *fr. Presented by the Ministère des Colonies, Paris.*

A small sketch-map of the world on Mercator's projection, showing France and the French possessions in red, and the twenty-four time divisions, starting with the Greenwich meridian in the centre of the first hour, clearly indicated by black lines.

CHARTS.

Admiralty Charts. **Hydrographic Department, Admiralty**

Charts and Plans published by the Hydrographic Department, Admiralty, from July 20 to August 30, 1913. *Presented by the Hydrographer, Admiralty.*

New Charts—No. 1616, Wales, west coast: Port Madoc, Approaches to Dinlleyn bay, 3*s*. 1721, England, east coast: Alnmouth bay (Plan: North Sunderland harbour), 3*s*. 2289, North sea: Skagerrak, 3*s*. 2865, Baltic sea, Germany: Mecklenburger bucht and Lübecker bucht (Plans: Travemünde, Warnemünde hafen), 4*s*. 1453, China, east coast—Plans in the southern approach to the Yang-tse kiang): Parker islands, Alacrity anchorage, 3*s*. 882, Korea, east coast: Chukupen bay to Suon kutchi (Cape Duroch) (Plans: Uruyon to Matsu sima), Chumonjin road, Kojin road), 3*s*. 762, Central America and West Indies: West India islands and Caribbean sea (Sheet 2), comprising the Lesser Antilles and coasts of South and Central America from Trinidad to Yucatan, 5*s*. **New Editions**—Y, The World: Index chart of Admiralty Sailing Directions, 1*s*. 2459, Pacific ocean: North-west Pacific ocean, including Yellow, Japan, and Okhotsk seas, the Kuril islands, and Kamchatka, 3*s*. 2202*a*, Atlantic ocean: South Atlantic ocean, eastern portion (Plans: Lindsay island), 4*s*. 1967, England, south coast: Plymouth sound, 3*s*. 30, England, south coast, Plymouth sound and Hamoaze, 5*s*. 1479, Norway: The Naze to the North Cape, 3*s*. 3377, Norway, west coast: Ure to Brettesnes, 3*s* 1104, France and Spain: Bay of Biscay, 4*s*. 2602, France, north coast: Port de Cherbourg, 3*s*. 2100, France, north coast: Plateau des Minquiers, 2*s*. 80, Spain, west coast: Port of Ferrol, 3*s*. 1758, Spain, west coast: Arosa and Pontevedra bays, 3*s*. 3414, Mediterranean, France: Approaches to Marseille (Plan added: Port de Bouc), 3*s*. 2607, Mediterranean, France: Marseille to Agay road, 3*s*. 198, Mediterranean, Italy: Policastro to Cape Santa Maria di Leuca, including the Strait of Messina (Plans: Port Santa Venere, Cotrone and Cape Colonne anchorages, Port Cotrone, Santa Maria di Leuca anchorage) (New plan of Cape Rizzuto on this sheet), 3*s*. 2836*a*, Mediterranean: Archipelago (southern sheet) (Plans: Kandeliusa, Marmarice harbour, Makri harbour, Port of Rhodes, Port Lindos, The Peiræus or Port Drako, Port Maltezana, Port St. Nikolo, Port Kheli, Strait of Samos or Samos-boghaz), 3*s*. 1854, Atlantic ocean, Azores: San Miguel (Plan: Villa Franca road) (Plan of Caldeira das Sete Cidades on this sheet erased. New plan of Ponta Delgada on this sheet, 2*s*. 1226, Africa, west coast: Strait of Gibraltar to the River Gambia, 3*s*. 594, Africa, west coast: River Gambia to Cape Lopez and Anno Bom, including the Bight of Biafra, 3*s*, 897, Africa, west coast: Milkbosch point to Orange river (Plan: MacDougall harbour), 2*s*. 1920, Africa, south-west coast: Table bay, 3*s*. 2899, Indian ocean: Chagos archipelago to Madagascar, 3*s*. 794 Malacca strait: Pulo Berhala to Cape Rachado, 3*s*. 3646, China, Canton river: Whampoa to Canton (sheet 1), 3*s*. 1519, China, south coast (Plans in the Si kiang or West river): Sam shui reach, Tak hing, Wu chau fu (Plan of Sheung lung rock on this sheet erased), 2*s*. 2678, China: Yang tse kiang (sheet 2), Nanking to Tung liu (Plan: Nanking

anchorage), 3*s*. 993, Japan: Anchorages in Yezo island, Otaru ko, Suttsu bay, Urakawa bay (Plan of Malo yama on this sheet erased), 2*s*. 654, Arctic ocean; Bering strait, 3*s*. 128, Japan, inland sea: Channels between Bingo nada and Ozuchi jima, Mu shima to Ozuchi jima, 3*s*. 3019, Japan, Kiusiu: Imari wan and approaches (Plan: Hibi suido), 3*s*. 2759*b* Australia: Australia, southern portion, 3*s*. 783, Pacific ocean: Pacific ocean comprised between the parallels of 37° north and 37° south, and extending from the Philippines and Celebes islands, New Guinea and Australia, to San Francisco and Easter island (south-east sheet), 3*s*. 3731, Pacific ocean, Society islands: Papiete harbour, 2*s*. 1300, South America, west coast (Plan on the coast of Chile): Maitencillo cove, Huentelauquen cove, Algarrobo road, Ligua bay, Pichidanque bay, Port Papudo, Horcon and Quintero bays (Plan added: Conchali bay and Port Vilos), 2*s*. 1503, Central America, east coast: Pearl cays, 2*s*. 255, West India, Jamaica: Morant point to Port Royal (Plan: Morant bay and the coast from Fisherman bay to Belvidere point) (Plan of Morant cays on this sheet erased) (Plan added: Port Morant), 3*s*. 267, United States, east coast: Albemarle sound to Cape Fear (New plans of Hatteras inlet and Ocracoke inlet on this sheet), 3*s*. 337, Canada, Lake Ontario: Toronto harbour, 2*s*. 282, Newfoundland: St. John bay to Orange bay, and Strait of Belle Isle (Plan of Ariège bay on this sheet erased), 3*s*. 2200, Newfoundland, west coast: Port Saunders, Keppel harbour, and Hawke bay (Plan added: Savage island anchorage and Old Port au Choix), 3*s*.

J. D. Potter, Agent.

Atlantic, South. **U.S. Hydrographic Office.**

Pilot chart of the South Atlantic Ocean, September, October, and November, 1913. Washington: U.S. Hydrographic Office, 1913. *Presented by the U.S. Hydrographic Office.*

French Equatorial Africa. **Mission Hydrographique du Gabon.**

Côte ouest d'Afrique. Baie de Pointe Noire, plan levé en 1910, echelle de 1:10,000 (6·3 inches to 1 stat. mile); Baie du Cap Lopez, Mouillage de Mandji, plan levé en 1911, echelle 1:10,000 or 6·3 inches to 1 stat. mile; Bas-Ogooué, croquis effectués d'Août à Octobre 1911, echelle 1:50,000 (1·3 inch to 1 stat. mile), par ordre de M. Martial Merlin, Gouverneur Général de l'Afrique Equatoriale Française sous la direction du Lieutenant de Vaisseau Audoin, Chef de la Mission Hydrographique du Gabon. Paris: Ministère des Colonies, [1913]. *Presented by M. le Gouverneur Général de l'Afrique Equatoriale Française.*

India. **Rennell.**

Major Rennell's Survey of the Ganges and Tributaries, being thirty-three charts lithographed from the originals deposited in the Map Room at the India Office, dated 1764. *Presented by the India Office.*

Last year the Survey of India reproduced in facsimile Major Rennell's Bengal Atlas of 1783, and this was noticed in the *Geographical Journal* for January, 1912. Important additions to this are the facsimiles of the large-scale charts of the Ganges and tributaries mentioned above, from surveys by Major Rennell dated 1764, and taken from the originals deposited in the Map Room of the India Office. There are altogether thirty-three of these, and their reproduction has been well advised, for they will be important and instructive for comparison with modern charts of the rivers in connection with changes that have taken place. Rennell's surveys were all made with the greatest care, and doubtless no pains were spared to render the work as accurate and complete as the time and means at his disposal would allow.

Indian Ocean. **U.S. Hydrographic Office.**

Pilot chart of the Indian Ocean, September, 1913. Washington: U.S. Hydrographic Office, 1913. *Presented by the U.S. Hydrographic Office.*

Pacific. **U.S. Hydrographic Office.**

Pilot chart of the North Pacific Ocean, September, 1913. Ditto, South Pacific Ocean, September, October, and November, 1913. Washington: U.S. Hydrographic Office, 1913. *Presented by the U.S. Hydrographic Office.*

N.B.—It would greatly add to the value of the collection of Photographs which have been established in the Map Room, if all the Fellows of the Society who have taken photographs during their travels, would forward copies of them to the Map Curator, by whom they will be acknowledged. Should the donor have purchased the photographs, it will be useful for reference if the name of the photographer and his address are given.

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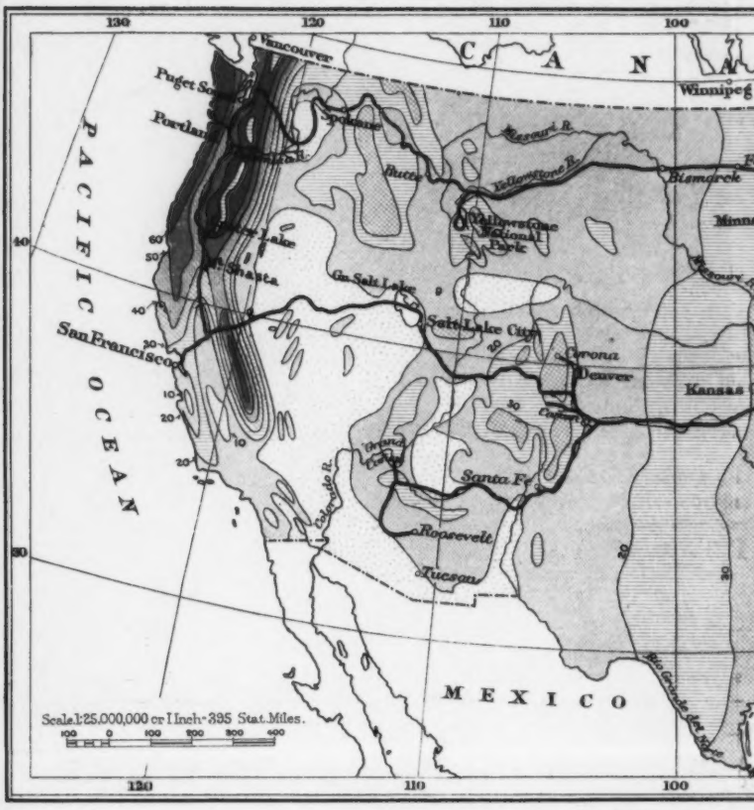

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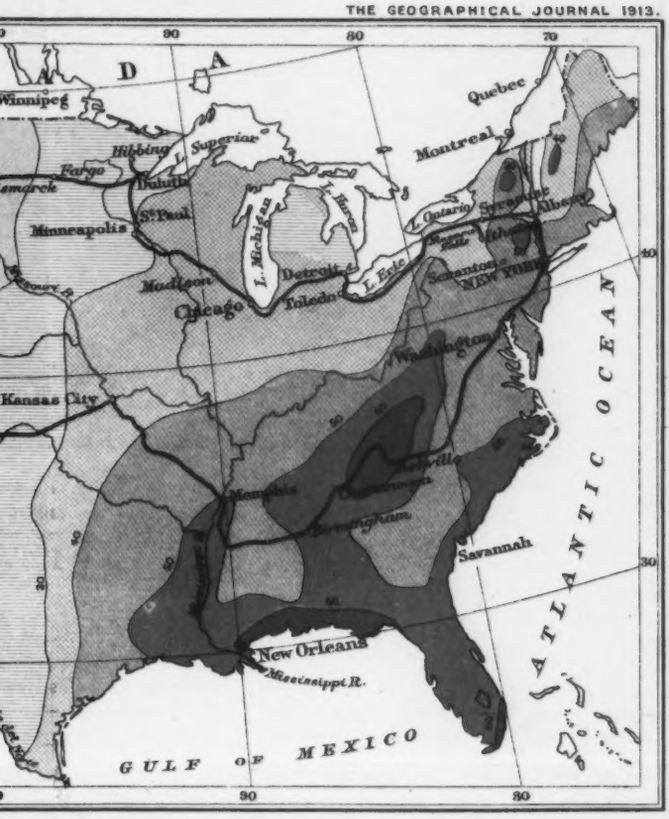
, MAINLY FROM DATA OF U.S. WEATHER
WATER SUPPLY PAPER 234: 1909.



ICAL SOCIETY'S EXCURSION 1912.

40-50 | 50-60 | ABOVE 60 INCHES

ATION

OXFORD WALL MAP.
RDY & PUBLISHED 1909)

ICAL SOCIETY'S EXCURSION 1912.

WESTERN CONIFEROUS FOREST | MIXED TEMPERATE FOREST | WARM TEMPERATE FOREST | GULF AND ATLANTIC COASTAL FOREST | HOT WET FOREST

UNITED STATES.
Ogilvie.

l Geographical Society.

Preliminary Chart showing the

DEEP SEA SOUNDINGS

taken on board the "AURORA" during
the 1st and 2nd years work of the

AUSTRALASIAN ANTARCTIC EXPEDITION

under

Dr. DOUGLAS MAWSON

1912 – 1913.

Scale 1: 15,000,000 or 1 Inch = 237 Stat. Miles.

100 0 100 200 300 400

g. *Gravel.* h. *Hard.* m. *Mud.* oz. *Ooze.* r. *Rock.*
s. *Sand.* sh. *Shells.* ss. *Sandstones.*
Depths in fathoms.

Note.

Names underlined are those of land discovered by the Australasian Antarctic Expedition.
The Antarctic Coastline is only shown provisionally.
For further information see the articles by Sir J. Murray and Capt. J. K. Davis which accompany this chart in the "Geographical Journal" for October, 1913.
Soundings shown thus 1850 indicate no bottom.

120° 130° 140°

40° 50° 60°

80° 90° 100° 110° 120° 130° 140°

2530 (Scott)
2360 (Scott)
2360 (Scott)
2390 oz
2452 oz
2150
2330
2330

Heavy Pack Ice
Snow Covered Land 2500ft
Heavy Pack Ice
Adélie Land
King George V Land
Termination Barrier
Heavy Pack
Knox Land
Sea Ice
Queen Mary Land
Winter Qrs of the "Gauss" 90E. 3
Mt Gauss 1850
Kaiser Wilhelm II Land

Modified Conical Projection with rectified meridians and errorless parallels 40° and 70°

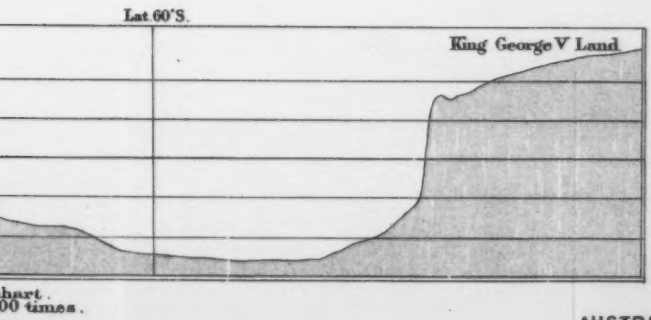
Fathoms

Lat 50°S.

Tasmania
Sea Level
0
500
1000
1500
2000

Horizontal Scale same as chart.
Vertical Scale exaggerated 100 tim

Published by the Royal Geographical So



hart.
00 times.
ical Society

DEEP SEA SOUNDINGS
AUSTRALASIAN ANTARCTIC EXPEDITION.